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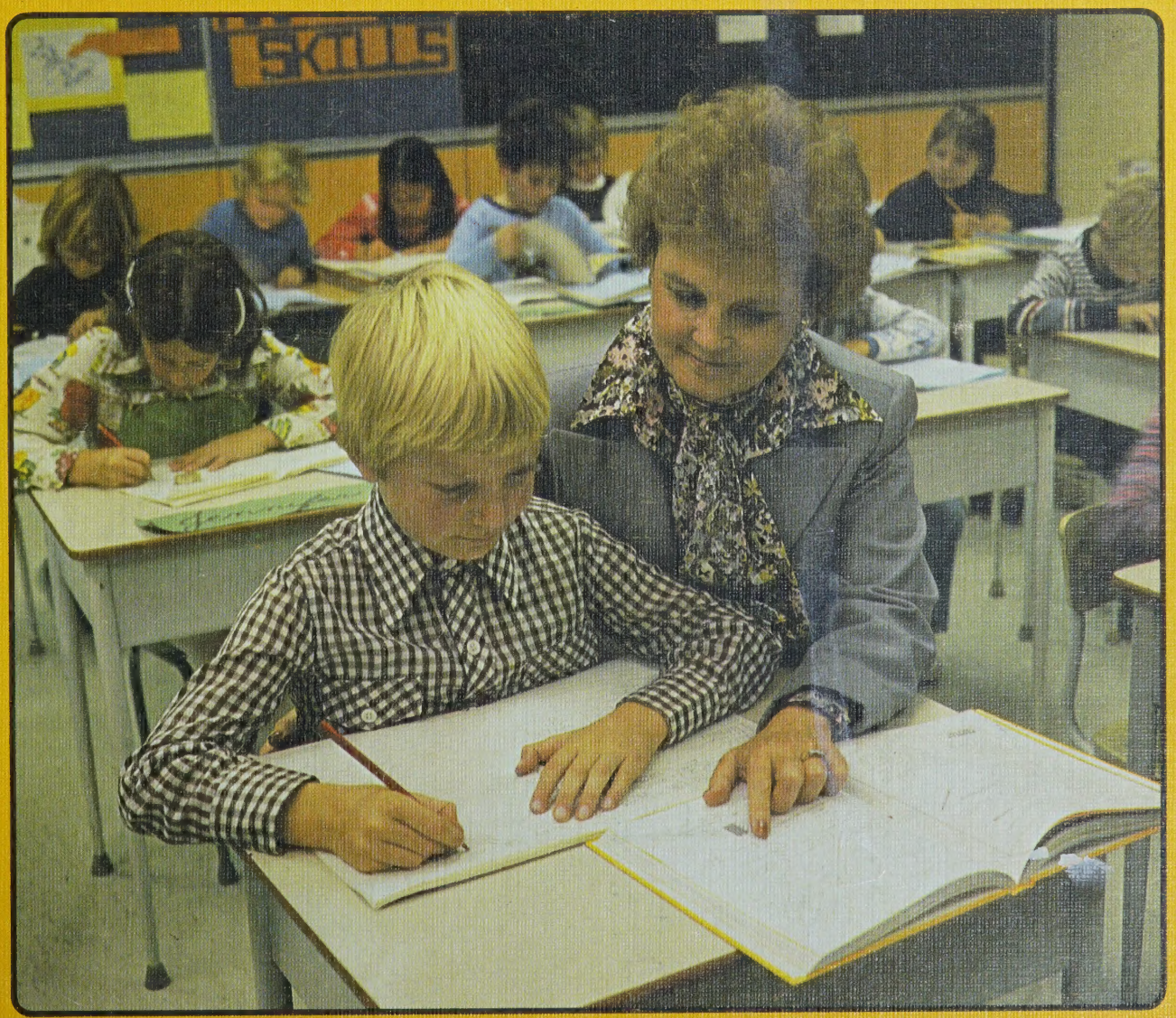
starting points in mathematics 4

teacher's edition



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Teacher's Edition for

starting points in mathematics

Mathematics Team
Level 4

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GINN AND COMPANY
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In each Teacher's Edition of *Starting Points in Mathematics*, the pages for the student's book are referred to by numeral only, while pages in the teacher's edition are designated by the letter T and a numeral.

Authors and Consultants

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Trudy is currently employed at the Joy in Learning Curriculum Development and Teacher Training Centre in Toronto. She studied at Calvin College in Michigan and at the University of Alberta in Calgary. Her background in mathematics includes teaching in elementary schools in Alberta, British Columbia, and Ontario. She is active in curriculum development for the primary and junior grades and conducts mathematics workshops for teachers. She has worked on the program as an author of material for Grades 3 to 6.

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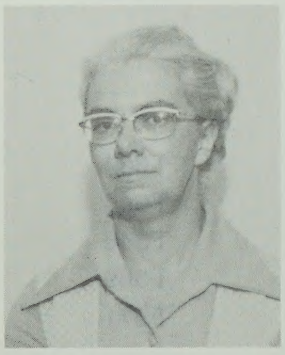
Don has a Bachelor of Arts degree from the University of Western Ontario, a Bachelor of Pedagogy degree from the University of Toronto, and courses toward a Ph.D. at Columbia University. His background in mathematics has included teaching elementary and junior-high school in Kitchener and Simcoe; principal in Sherbrooke, Quebec; superintendent in Kirkland Lake, Ontario; inspector and assistant area superintendent of schools for the North York Board of Education; lecturer for the Ontario Department of Education at State College of Victoria, Melbourne, Australia; senior author of another mathematics series. He is the senior author of the program.



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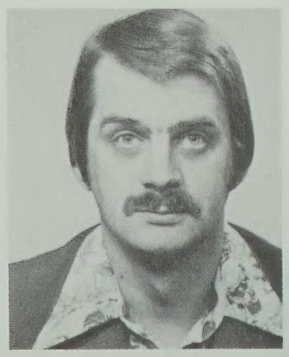

Emery Dosdall

Emery is currently the Director of Program Supervision (K-12) for the Edmonton Public Schools. He has a Bachelor of Education degree and a diploma in Educational Administration from the University of Alberta, and a Master of Education degree from the University of Oregon. Prior to his present appointment, he was Supervisor of Mathematics (K-12), lecturer at the University of Alberta, assistant principal, and consultant. He has worked extensively in elementary mathematics curriculum development for the Edmonton Public Schools and has participated throughout his home province and nationally in the development of mathematics. He has worked on the program from its beginning, evaluating manuscript, consulting at all grade levels, and coordinating and evaluating field-test material prior to publication.

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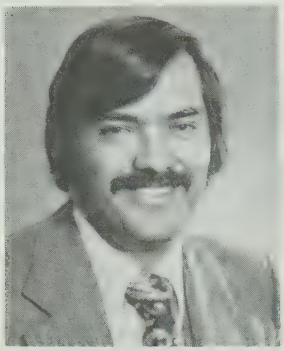

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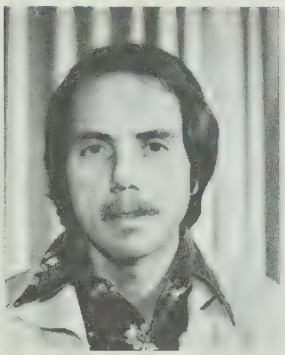

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Trudy has a Bachelor of Arts degree from York University. She has been an elementary teacher and is currently a General Consultant for the North York Board of Education and Program Leader in Language Arts and Mathematics. She developed the themes for the primary phase of the program.

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Gary is currently Principal of Robert Meek Public School in Kingston, Ontario. He has a Bachelor of Arts degree from Queen's University and is a graduate of Peterborough Teacher's College. His background in mathematics includes teaching at the primary, junior, and intermediate levels. He is active in curriculum development and writing and presenting suggestions and activities for classroom teachers. He has worked on the program as an author of material for Grade 4.

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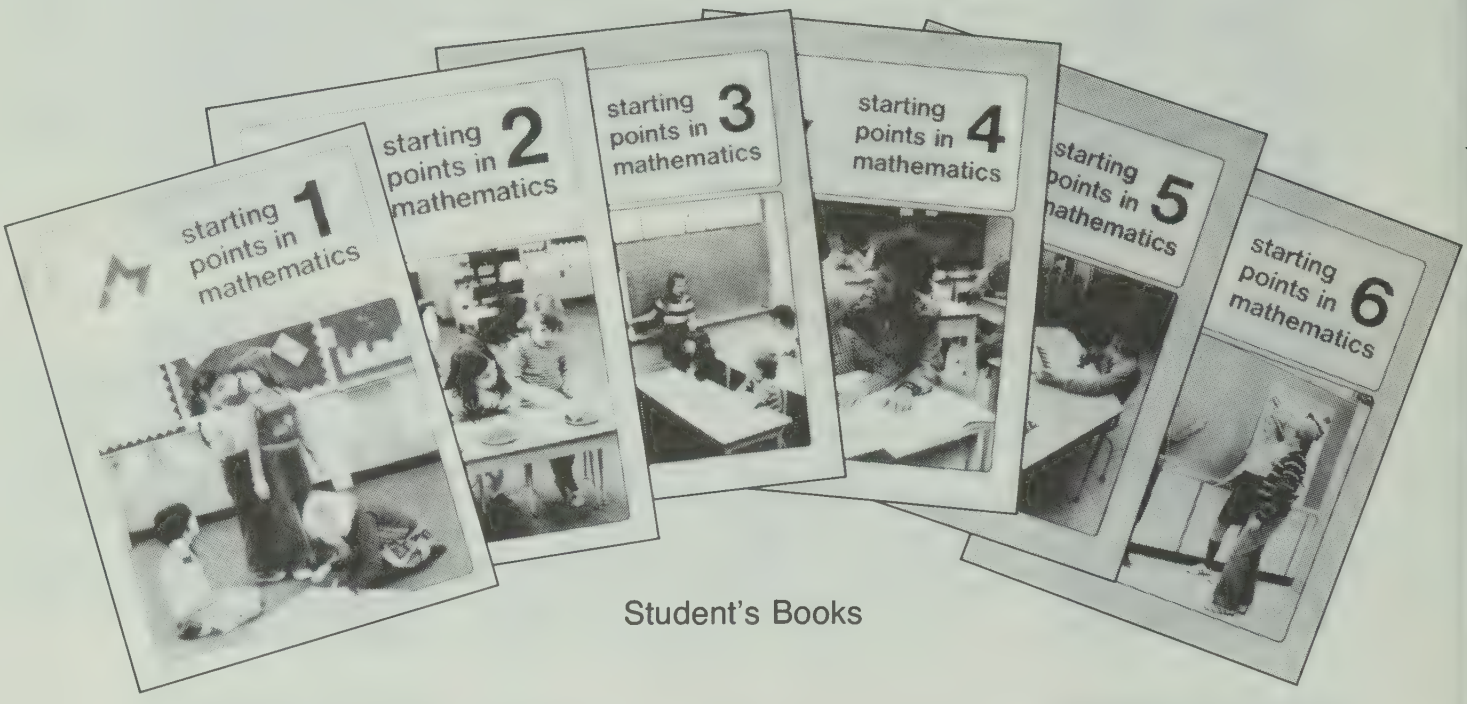
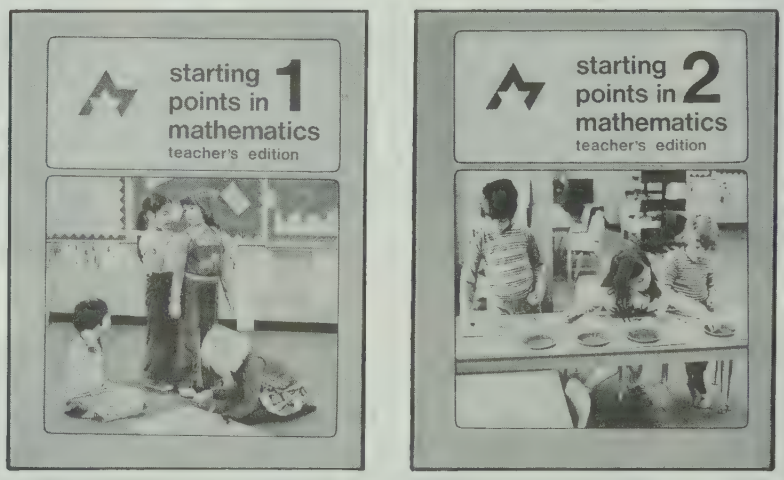
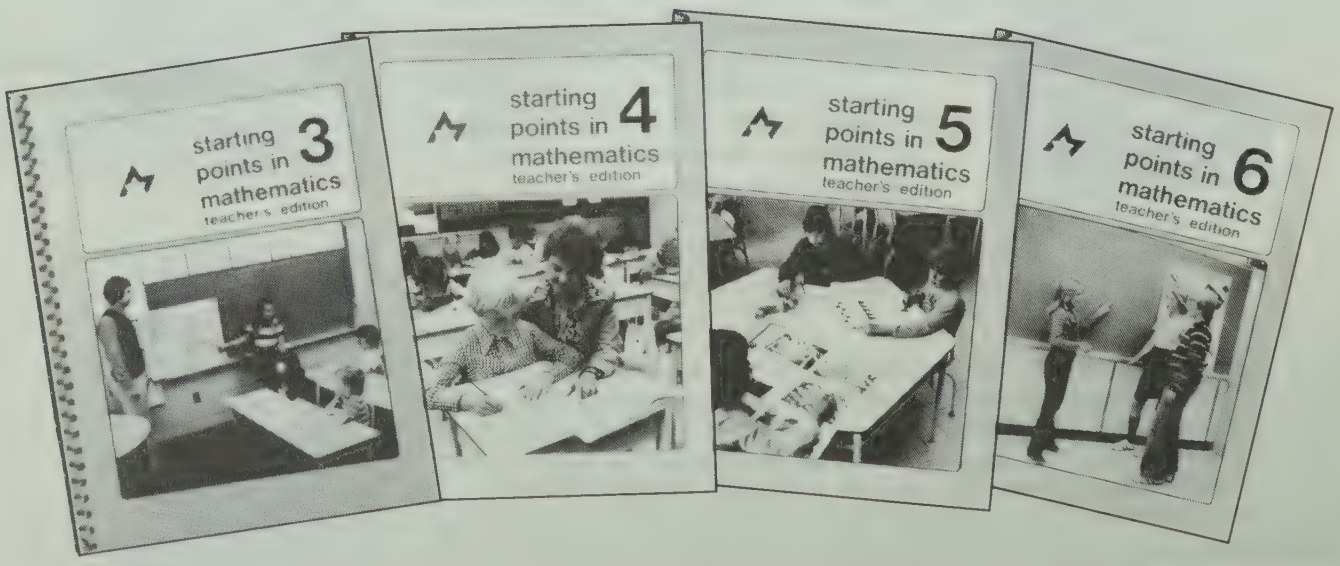
Mary received her education in England and carried on postgraduate work at Acadia University (M.Sc.), and Dalhousie University. She taught high school in England, New Brunswick, Nova Scotia, and Prince Edward Island. She was a lecturer and assistant professor of mathematics at Acadia University for ten years. Currently, she is Mathematics Consultant for the Regional Administrative Office of the Department of Education in Montague, Prince Edward Island. She has been active in mathematics in a number of capacities. She is a recipient of a Canada Council Scholarship for Teachers of Mathematics, and a member of the Canadian Mathematics Congress and of N.C.T.M. She has worked on the Grades 4 to 6 phase of the program in planning the development and evaluating manuscript.


starting points in 1 mathematics
starting points in 2 mathematics
starting points in 3 mathematics
starting points in 4 mathematics
starting points in 5 mathematics
starting points in 6 mathematics

Student's Books

Teacher's Editions





rogram Highlights

ontent

Computation strands that maintain a balance between concepts and skills

A metric Measurement strand using units and symbols in accordance with the National Standards of Canada

A Decimals and Fractions strand that reflects the more significant role of decimals in a metric world

A Geometry strand that introduces transformation geometry topics in addition to the more traditional topics

A Problem Solving strand that identifies specific problem solving skills and strategies

Lessons on using a calculator to reinforce the understanding of number operations and as an aid for checking results

evelopment

Computational concepts and skills built upon the basic facts, the continued manipulation of concrete materials, place value, systematic development of the algorithms, and practice

Measurement concepts and skills introduced using non-standard units; refined and developed using only approved metric units

Decimals introduced with the parts-of-a-whole concept and developed by extending the place-value concepts of whole numbers

Corresponding ideas among the Numeration, Computation, Measurement, and Decimals strands treated as mutually supportive concepts for both development and reinforcement

Problem Solving strand integrated with the other strands

Material provided for maintenance of computational skills

For the Student

- A highly visual program placing mathematics ideas and experiences within meaningful settings of real-life objects and situations
- Uniform lesson structure with completed examples to illustrate each objective
- A variety of types of exercises
- Problems that provide reasons for learning mathematics
- *Special Features* showing mathematics in use in real-life situations and providing opportunities to be individually creative with mathematical skills in problem solving and enrichment activities

For the Teacher

- Manageable units for the development of concepts and skills
- Overviews that provide mathematics background and summarize the content of each unit
- Concise statements of lesson objectives
- Suggestions for activities to precede and follow each lesson in the book; suggestions for teaching each lesson in the book
- Uniform lesson structure that is adaptable to a variety of classroom strategies
- Unit themes that support the integration of mathematics with other areas of study, and suggestions on how this integration can be achieved
- Component skills necessary for achieving lesson objectives identified
- Assessment materials included in the book and the teacher's edition

Lesson outcome is stated.

Color and design are used to assist understanding.

A lesson begins with a worked example of what is to be learned.

10 MULTIPLICATION

Multiplying Two-Digit Numbers

3 Roadcruisers cross Newfoundland from St. John's to Port aux Basques each day. Each can carry 47 passengers. How many can they carry in all?

Multiply 3 and 47.

$$\begin{array}{r} 47 \\ \times\ 3 \\ \hline 21 \end{array}$$

$3 \times 7 = 21$

or 2 tens 1 one.

$$\begin{array}{r} {\scriptstyle 2} \\ 47 \\ \times\ 3 \\ \hline 1 \end{array}$$

$$\begin{array}{r} 47 \\ \times\ 3 \\ \hline 21 \\ 120 \end{array}$$

3×4 tens $= 12$ tens

and 2 more tens are 14 tens.

$$\begin{array}{r} {\scriptstyle 2} \\ 47 \\ \times\ 3 \\ \hline 141 \end{array}$$

This is the standard form for multiplying.

$$\begin{array}{r} 47 \\ \times\ 3 \\ \hline 21 \\ 120 \\ \hline 141 \end{array}$$

Add.

The standard form lets me write the product on the first line below the two factors.

The Roadcruisers can carry 141 passengers.

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The development of a concept enables the student to move from the use of concrete materials to the use of abstract number sentences and algorithms.

Special Features

Practice with addition, subtraction, multiplication, and division

KEEPING SHARP

Some interesting ideas for fun and enrichment

try this

Lessons and activities to help in learning the skills needed for solving problems

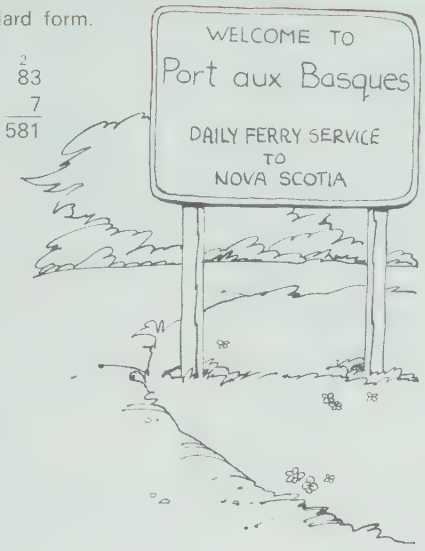
PROBLEM SOLVING

Working Together

Show each multiplication in the standard form.

Example: 83×7 becomes $\begin{array}{r} {\scriptstyle 2}\,83 \\ \times\ \ 7 \\ \hline 581 \end{array}$

$\begin{array}{r} 83 \\ \times\ \ 7 \\ \hline 21 \\ 560 \\ \hline 581 \end{array}$ 7×3 7×80



1. $\begin{array}{r} 32 \\ \times\ \ 3 \\ \hline 6 \\ 90 \\ \hline 96 \end{array}$ **2.** $\begin{array}{r} 73 \\ \times\ \ 9 \\ \hline 27 \\ 630 \\ \hline 657 \end{array}$ **3.** $\begin{array}{r} 65 \\ \times\ \ 8 \\ \hline 40 \\ 480 \\ \hline 520 \end{array}$

Multiply. Use the standard form.

4. $\begin{array}{r} 24 \\ \times\ \ 2 \\ \hline \end{array}$ **5.** $\begin{array}{r} 87 \\ \times\ \ 3 \\ \hline \end{array}$ **6.** $\begin{array}{r} 48 \\ \times\ \ 7 \\ \hline \end{array}$

Exercises

Multiply. Use the standard form.

1. $\begin{array}{r} 16 \\ \times\ \ 4 \\ \hline \end{array}$ **2.** $\begin{array}{r} 21 \\ \times\ \ 8 \\ \hline \end{array}$ **3.** $\begin{array}{r} 94 \\ \times\ \ 5 \\ \hline \end{array}$ **4.** $\begin{array}{r} 54 \\ \times\ \ 6 \\ \hline \end{array}$ **5.** $\begin{array}{r} 96 \\ \times\ \ 2 \\ \hline \end{array}$ **6.** $\begin{array}{r} 56 \\ \times\ \ 7 \\ \hline \end{array}$ **7.** $\begin{array}{r} 35 \\ \times\ \ 5 \\ \hline \end{array}$

8. $\begin{array}{r} 22 \\ \times\ \ 9 \\ \hline \end{array}$ **9.** $\begin{array}{r} 93 \\ \times\ \ 4 \\ \hline \end{array}$ **10.** $\begin{array}{r} 99 \\ \times\ \ 3 \\ \hline \end{array}$ **11.** $\begin{array}{r} 47 \\ \times\ \ 8 \\ \hline \end{array}$ **12.** $\begin{array}{r} 39 \\ \times\ \ 7 \\ \hline \end{array}$ **13.** $\begin{array}{r} 30 \\ \times\ \ 8 \\ \hline \end{array}$ **14.** $\begin{array}{r} 31 \\ \times\ \ 4 \\ \hline \end{array}$

15. $\begin{array}{r} 87 \\ \times\ \ 2 \\ \hline \end{array}$ **16.** $\begin{array}{r} 62 \\ \times\ \ 5 \\ \hline \end{array}$ **17.** $\begin{array}{r} 64 \\ \times\ \ 7 \\ \hline \end{array}$ **18.** $\begin{array}{r} 26 \\ \times\ \ 3 \\ \hline \end{array}$ **19.** $\begin{array}{r} 90 \\ \times\ \ 9 \\ \hline \end{array}$ **20.** $\begin{array}{r} 95 \\ \times\ \ 7 \\ \hline \end{array}$ **21.** $\begin{array}{r} 64 \\ \times\ \ 9 \\ \hline \end{array}$

22. 9×31 **23.** 5×47 **24.** 6×33 **25.** 6×71 **26.** 8×78

27. 2×49 **28.** 7×72 **29.** 6×27 **30.** 3×35 **31.** 6×48

Solve.

32. Mr. Brock travels 37 km on the bus each day. How far does he travel on the bus in 5 working days?

33. Adult fare for the Roadcruiser across Newfoundland is about $23. About how much would 4 adults have to pay?

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Working Together shows the steps of what is to be learned.

Exercises give practice and provide applications of what has been learned.

Word problems whose solutions incorporate the skills taught are included.

Wherever possible, the integrating themes of the units are incorporated into the development of concepts.

Special * exercises provide more practice with problem solving.

Checking Up

End-of-unit lessons provide a check of the understanding of the work of the unit.

Checking Skills

Special reviews provide a check of skills with addition, subtraction, multiplication, and division.

Features of the Teacher's Edition

A lesson outline may include some or all of the following:

1 The page references to the student's book

2 The outcome(s) for the lesson

3 Some of the materials that would be desirable for introducing and developing the lesson

4 A reference to a page that may be copied to provide cutouts for the students

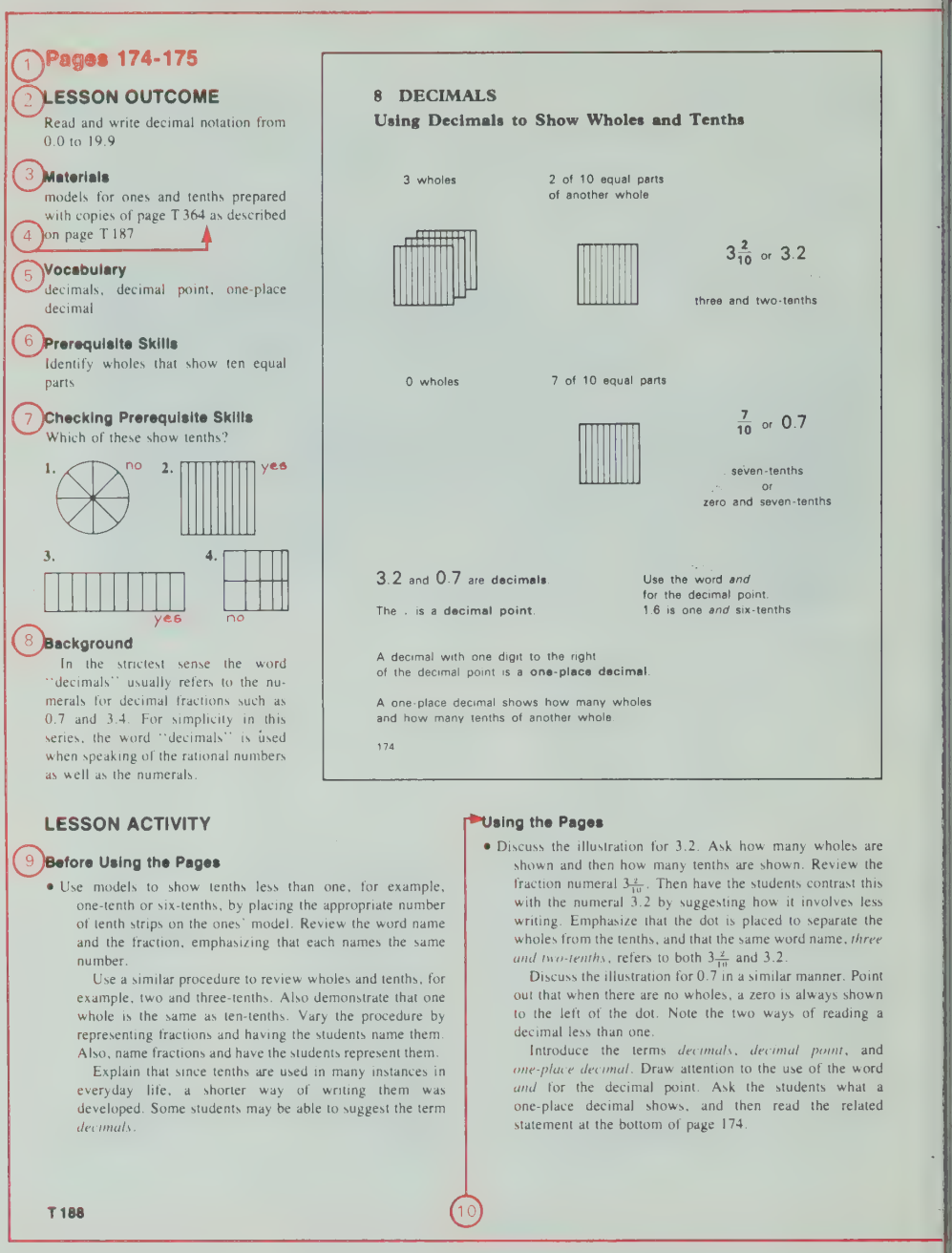
5 Mathematical terms used for the first time and other words useful for discussing the development of the topic on the page

6 Identification of concepts and skills that students should be able to perform prior to the lesson

7 Suggested tasks for assessing prerequisite skills

8 Comments about the content of the lesson

9 Activities for developing the lesson concepts, and suggestions for introducing new words and symbols



1 **Pages 174-175**

2 **LESSON OUTCOME**

Read and write decimal notation from 0.0 to 19.9

3 **Materials**

models for ones and tenths prepared with copies of page T 364 as described on page T 187

4

5 **Vocabulary**

decimals, decimal point, one-place decimal

6 **Prerequisite Skills**

Identify wholes that show ten equal parts

7 **Checking Prerequisite Skills**

Which of these show tenths?

1. no 2. yes 3. yes 4. no

8 **Background**

In the strictest sense the word "decimals" usually refers to the numerals for decimal fractions such as 0.7 and 3.4. For simplicity in this series, the word "decimals" is used when speaking of the rational numbers as well as the numerals.

8 DECIMALS

Using Decimals to Show Wholes and Tenths

3 wholes — 2 of 10 equal parts of another whole — $3\frac{2}{10}$ or 3.2 — three and two-tenths

0 wholes — 7 of 10 equal parts — $\frac{7}{10}$ or 0.7 — seven-tenths or zero and seven-tenths

3.2 and 0.7 are **decimals**.

The . is a **decimal point**.

Use the word *and* for the decimal point. 1.6 is one *and* six-tenths

A decimal with one digit to the right of the decimal point is a **one-place decimal**.

A one-place decimal shows how many wholes and how many tenths of another whole.

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LESSON ACTIVITY

9 **Before Using the Pages**

- Use models to show tenths less than one, for example, one-tenth or six-tenths, by placing the appropriate number of tenth strips on the ones' model. Review the word name and the fraction, emphasizing that each names the same number.

  Use a similar procedure to review wholes and tenths, for example, two and three-tenths. Also demonstrate that one whole is the same as ten-tenths. Vary the procedure by representing fractions and having the students name them. Also, name fractions and have the students represent them.

  Explain that since tenths are used in many instances in everyday life, a shorter way of writing them was developed. Some students may be able to suggest the term *decimals*.

Using the Pages

- Discuss the illustration for 3.2. Ask how many wholes are shown and then how many tenths are shown. Review the fraction numeral $3\frac{2}{10}$. Then have the students contrast this with the numeral 3.2 by suggesting how it involves less writing. Emphasize that the dot is placed to separate the wholes from the tenths, and that the same word name, *three and two-tenths*, refers to both $3\frac{2}{10}$ and 3.2.

  Discuss the illustration for 0.7 in a similar manner. Point out that when there are no wholes, a zero is always shown to the left of the dot. Note the two ways of reading a decimal less than one.

  Introduce the terms *decimals*, *decimal point*, and *one-place decimal*. Draw attention to the use of the word *and* for the decimal point. Ask the students what a one-place decimal shows, and then read the related statement at the bottom of page 174.

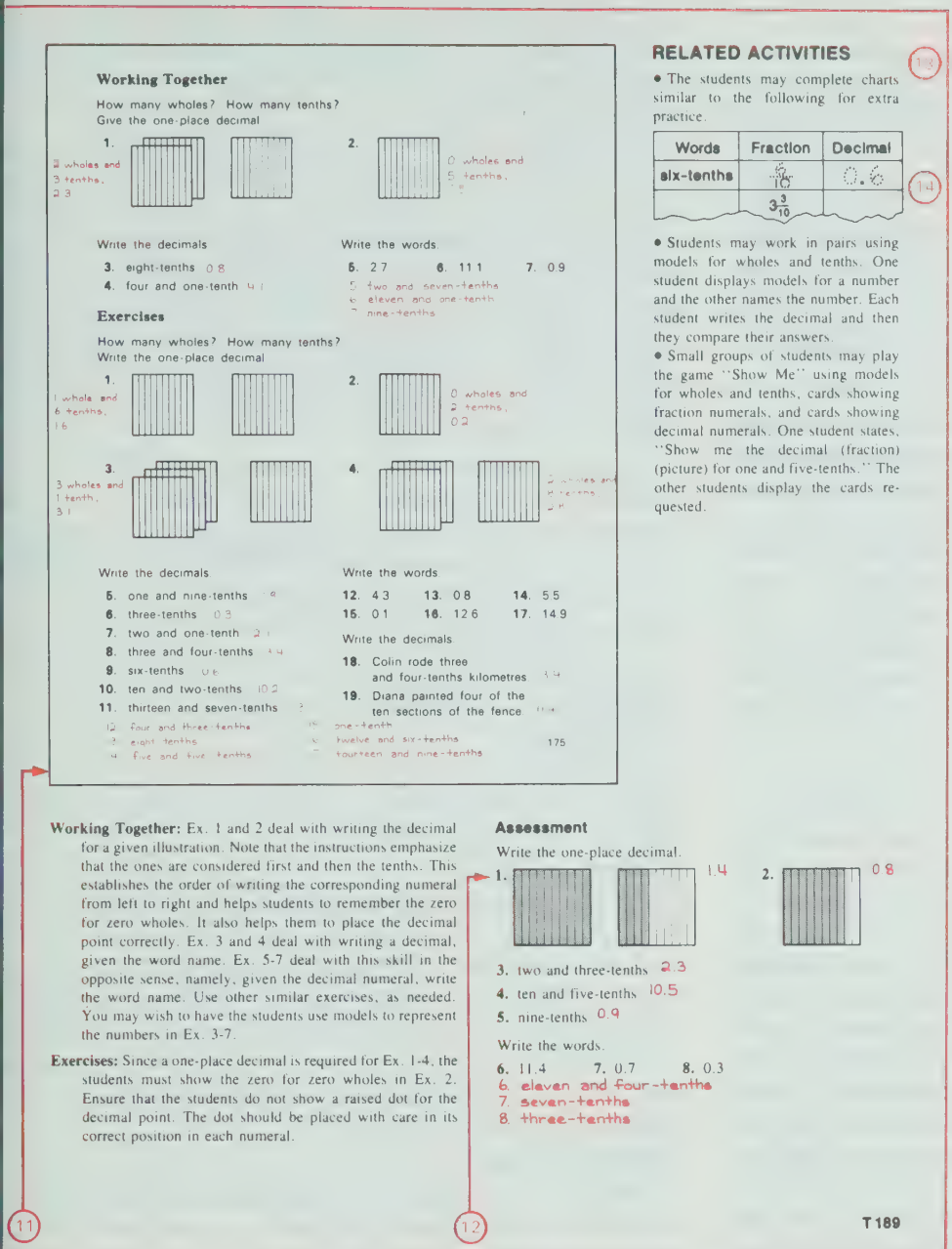
T 188

10

10 Suggestions for using the pages

Overviews

The overview at the beginning of each unit includes a list of the prerequisite skills that are required for successful completion of the unit, the outcomes for the developmental lessons in the unit, mathematical background, comments about the content and how the unit fits with the other units in the program, teaching strategies, materials, and vocabulary.



Working Together

How many wholes? How many tenths?
Give the one-place decimal

1. 2 wholes and 3 tenths. 2.3
2. 0 wholes and 5 tenths. 0.5

Write the decimals.

3. eight-tenths 0.8
4. four and one-tenth 4.1

Write the words.

5. 2.7 two and seven-tenths
6. 11.1 eleven and one-tenth
7. 0.9 nine-tenths

Exercises

How many wholes? How many tenths?
Write the one-place decimal.

1. 1 whole and 6 tenths. 1.6
2. 0 wholes and 2 tenths. 0.2
3. 3 wholes and 1 tenth. 3.1
4. 2 wholes and 4 tenths. 2.4

Write the decimals.

5. one and nine-tenths 1.9
6. three-tenths 0.3
7. two and one-tenth 2.1
8. three and four-tenths 3.4
9. six-tenths 0.6
10. ten and two-tenths 10.2
11. thirteen and seven-tenths 13.7
12. four and three-tenths 4.3
13. eight-tenths 0.8
14. five and five-tenths 5.5
15. one-tenth 0.1
16. twelve and six-tenths 12.6
17. fourteen and nine-tenths 14.9

Write the words.

18. Colin rode three and four-tenths kilometres 3.4
19. Diana painted four of the ten sections of the fence. 0.4

175

RELATED ACTIVITIES 13

- The students may complete charts similar to the following for extra practice.

Words	Fraction	Decimal
six-tenths	$\frac{6}{10}$	0.6
	$3\frac{3}{10}$	

14

- Students may work in pairs using models for wholes and tenths. One student displays models for a number and the other names the number. Each student writes the decimal and then they compare their answers.
- Small groups of students may play the game "Show Me" using models for wholes and tenths, cards showing fraction numerals, and cards showing decimal numerals. One student states, "Show me the decimal (fraction) (picture) for one and five-tenths." The other students display the cards requested.

Working Together: Ex. 1 and 2 deal with writing the decimal for a given illustration. Note that the instructions emphasize that the ones are considered first and then the tenths. This establishes the order of writing the corresponding numeral from left to right and helps students to remember the zero for zero wholes. It also helps them to place the decimal point correctly. Ex. 3 and 4 deal with writing a decimal, given the word name. Ex. 5-7 deal with this skill in the opposite sense, namely, given the decimal numeral, write the word name. Use other similar exercises, as needed. You may wish to have the students use models to represent the numbers in Ex. 3-7.

Exercises: Since a one-place decimal is required for Ex. 1-4, the students must show the zero for zero wholes in Ex. 2. Ensure that the students do not show a raised dot for the decimal point. The dot should be placed with care in its correct position in each numeral.

11

Assessment

Write the one-place decimal.

1. 1.4
2. 0.8
3. two and three-tenths 2.3
4. ten and five-tenths 10.5
5. nine-tenths 0.9

Write the words.

6. 11.4 eleven and four-tenths
7. 0.7 seven-tenths
8. 0.3 three-tenths

12

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11 Reduced pages from the student's book with answers indicated

12 Exercises to evaluate the learning outcome

13 Suggested activities and games which may be used to reinforce, extend, or enrich a particular topic

14 Illustrations of suggested materials

Answers

Answers for the exercises are given on each reduced page from the student's book.

Other Materials

- Themes
- Games and Teaching Aids
- Pages for Reproduction
- Year-End Evaluation Chart
- Index for Student's Book

Using the Introductory Material

Knowing what the *Starting Points in Mathematics* program can do and what it cannot do is an important place to begin. There are two features to help you. First, the Scope and Sequence chart shows the content by grade level and allows you to locate particular topics in the overall development. Secondly, each unit begins with an overview which summarizes the content of the unit, includes mathematics background for the teacher, and suggests strategies for class organization and teaching.

Presenting the Lessons

The organization of the teaching suggestions for each lesson has built-in strategies to motivate and teach, and for practice and application. The identification of *Prerequisite Skills* and concepts are stated in terms of tasks students should be able to perform prior to the lesson. Teachers will want to assess prerequisite skills in certain instances; for example,

- for topics that have proven traditionally difficult,
- for new mathematics topics in the curriculum,
- with students who have missed school or been transferred,
- at the beginning of the year when the mathematical levels of the students may be uncertain,
- as a starting point to work with students who have not been successful with the previous lesson.

In the *Before Using the Page(s)* section, most lessons are initiated with concrete material to provide a review, an appropriate warm-up, or activities designed to lead students to discover a concept or a skill.

The teaching suggestions in the *Using the Page(s)* section emphasize the key aspects of the teaching example and, at times, suggest a possible sequence. When students are ready to work the exercises independently, they will benefit from a full explanation of the teaching example as a guide for their work. The teaching suggestions follow naturally from the preliminary activities and allow you to develop the lesson outcomes from the students' page(s).

In all teaching lessons, the *Working Together* section provides an examination of the sub-skills and/or the sequence of steps leading to the outcome. This section allows for immediate feedback of the students' understanding of the lesson. In this regard, this section may be completed orally or on the board. Students experiencing difficulty with the exercises can be referred to the appropriate example. *Working Together* provides another opportunity to see how all the steps of the lesson combine and, consequently, provides a means for diagnosing the students' understanding.

Each teaching lesson provides material in the *Assessment* section to evaluate the learning outcome. If the material is not used following the lesson, teachers may consider using it for pretesting or reviewing.

Most of the *Related Activities* can be used for all the students. The suggestions in this section try to provide a balance between reinforcement, enrichment, and review.

Grouping for Instruction

Knowing what to teach is one thing, knowing how to adapt a program for individual differences in ability and capacity for achievement is the ongoing role of all teachers.

It is possible to work with lower achievers and higher achievers by using the same material but by altering the teaching procedure. Lower achievers, as in other subjects, need a slower pace to provide for maximum use of concrete materials and pictorial representations as well as varied activities to ensure understanding.

With higher achievers you will often wish to move at a faster pace. This does not mean a more rapid movement through the lessons, but rather a change in approach. All students need the benefits derived from the use of concrete materials for both present and future understandings, but higher achievers tend to move more readily from the concrete to the abstract levels of mathematical thinking. They grasp concepts and skills quickly and will benefit from exploration and challenges that will allow them to use and broaden their newly acquired abilities in different settings.

Grouping for instruction is dependent on a number of factors including teacher preference, teaching strategy, social and academic needs of students, abilities and skills of the students, the need to vary instruction, the organization of the classroom. Some possible ways for grouping are given below.

The Whole Class

Instruction of the whole class is appropriate for the introduction of new topics or class projects.

Skill Groups

For this grouping the teacher selects students having similar needs for the teaching of a specific skill. When the skill is mastered, the group is dissolved.

Interest Groups

For this grouping a student chooses to be a member of the group based on interest in the activity being offered. For example, while one concept is being explored by the whole class, a student may have the choice of working at the board or with activity cards. Interest groups may be formed for the study of a theme or for a group project. This kind of grouping promotes sharing among students and offers opportunities for students to display leadership.

Random Groups

This type of grouping may be as arbitrary as the grouping of all students wearing something red or as open as to include groups of friends. It is especially suited to situations involving games, experiments, and making things, for example, models of three-dimensional shapes.

Often students may be part of a group, but they may work independently within the group. It is here that the teacher may observe and plan for individual needs.

Providing for Individual Differences

Use the daily performance and test results to assess the needs and abilities of the students.

For lower achievers, plan to make more extensive use of the *Prerequisite Skills* assessment before starting a lesson, the *Working Together* section, and the appropriate selection of activities from the *Related Activities*. The *Keeping Sharp* sections provide continued practice for the basic operations.

Higher achievers will benefit from the flexibility and variation of the teaching model and a wider exposure to the special features *Try This* and *Problem Solving*. The *Related Activities* provide suggestions for enrichment topics.

All students will benefit from the formal lesson on problem solving found at the end of each of the thirteen units.

roblem Solving

The problem-solving strand is integrated and interspersed roughout *Starting Points in Mathematics 4*. There are thirteen aching lessons on specific skills, seventeen special feature ctions presenting problems, often as extensions of material nder study, and starred problems that require special attention integrate what has been learned in the problem solving lessons to the exercises.

Students will benefit from specific instruction on problem lving, the concrete presentation of concepts and skills in all e lessons where this is possible, and meeting problem solving quirements in a meaningful context. The material in this rand, however, is by no means exhaustive. Teachers will apture the right moments in their daily contact with the students provide the insights and skills to develop better problem lving techniques.

esting and Evaluation

The *Checking Up* feature at the end of each unit reviews the kills taught in the unit and helps to evaluate the students' rogress. It could also be used as a pretest for the unit.

The chart in the teacher's edition for each *Checking Up* eature is designed to help locate strengths and weaknesses. The *kills* section of the chart lists the skills taught in the unit. The *xercises* section lists the exercises in *Checking Up* correspond- ng to each skill identified. The *Related Pages* section lists the ages in the teacher's edition where the skill is taught. You may vish to refer to these pages for reviewing or reteaching.

The comments below the chart discuss special aspects of the xercises. They point out possible difficulties and give uggestions for remedying the difficulties.

Students who demonstrate an understanding of the concepts nay benefit by using enrichment activities described in the eaching suggestions for the unit.

The *Checking Skills* pages at the end of Units 4, 7, 9, and 12 valuate students' ongoing performance in the four basic perations for whole numbers and decimals.

Many lesson outcomes can be and are evaluated by working vith students on a daily basis. The students' oral responses, vork on the board, and written assignments provide ongoing valuation including outcomes not measured by tests, for xample, attitudes and work habits.

If evaluation is to be an ongoing process, it is important to eep complete and accurate records of the achievement of each tudent. A file containing remarks on progress based on the bservation of the teacher and samples of the student's work is ecommended. The remarks can be dated and are an excellent eference when reporting to parents. The samples of work can be elected by both the teacher and the student. If the student plays n active part in contributing work which indicates her/his nastery of a concept, she/he also recognizes that learning is mportant. This is an essential factor in assuring future success.

The comprehensive evaluation chart on pages T 369 and T 370 s intended for use at the end of the school year, but it may be dapted for other uses. For example, if the indicated program is oo ambitious for all the students in a class, the chart may be sed as a guide for obtaining a minimum program or an average rogram for the students. The format of the chart may also be dapted as a report to show parents the progress their children ave made.

You may wish to adopt a code for recording the stages of development in each student's mastery of concepts and skills. Slashes and dots may be used in such a way that a box marked ☐ means that the student has been introduced to the concept or skill; a box marked ☒ means that the student understands the concept or skill; a box marked ▣ means that the student has mastered the concept or skill. Examples are shown below.

Adds four-digit numbers, regrouping	☐ (Exposure)
Relates subtraction to addition	☒ (Understanding)
Knows the basic facts, products to 81	▣ (Mastery)

A Thematic Approach to Mathematics

Six units of *Starting Points in Mathematics 4* have been considered from a thematic aspect. The considerations given to this aspect of curriculum planning did not alter the mathematics, but did provide opportunities to enhance the teaching strategies.

Teachers who attempt to provide an integrated curriculum frequently encounter difficulty interweaving the mathematics curriculum with other subjects and in creating sufficient real-life situations to make the association a meaningful one. The thematic organization is provided to assist those teachers who wish to organize their teaching in this manner. The themes have been selected

- to appeal to a wide range of students' interests,
- to provide suitable topics for integrating the curriculum,
- to suggest real-life situations that provide a framework for mathematical understanding.

Teachers who have never tried integrating mathematics may wish to experiment with one or more of the themes suggested. They may be surprised that there are practical aspects in using a thematic approach. For example, time can often be used more efficiently by integrating several subject areas. This approach also facilitates the planning of activities when working within the framework of a topic. Resources and materials required may serve several purposes; for example, art materials may be used as a method for communicating mathematical concepts.

The themes are prevalent in the visual material shown in each unit. Where possible, the concrete materials used in the teaching of a concept or in placing the mathematical problem in a social setting are chosen to fit the theme. In addition to this visual link, the teaching suggestions may include ideas on how to integrate the theme for a unit. The students may also make suggestions for activities they wish to explore. Involving the students in planning the activities within a theme is a valuable learning experience for them, and enables the teacher to observe and assess each student's development.

The themes for *Starting Points in Mathematics 4* are:

Unit 2 Farming: farming areas and kinds of farming in Canada; aspects of life on a farm

Unit 5 Food: classification and nutritional value of foods; observing the processing of food; patterns of growth in fruits and vegetables

Unit 6 Collections: kinds of collections; activities related to collections

Unit 7 Geometry Around Us: observing, creating, and demonstrating examples of geometric ideas

Unit 10 Transportation: history of transportation; methods, purposes, and difficulties of transportation

Unit 11 Sharing Experiences: sharing tasks at home, at school, and in the community

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cope and Sequence

	Grade 3	Grade 4	Grade 5
UMBER ND UMERATION	Read, write numerals from 0 to 9999 Place value for four-digit numbers, regrouping among the places Compare, order numbers to 9999 Expanded form Ordinal number concepts to *thirty-first*	Read, write numerals to 999 999 Place value for six-digit numbers Compare, order numbers to 999 999 Ordinal number concepts to 999 Round in tens' place, in hundreds' place, in thousands' place Roman numerals for 1 to 100	Read, write numerals to 999 999 999 Place value for nine-digit numbers Compare, order numbers to 999 999 999 Round in tens' place, in hundreds' place; in ones', tens', or hundreds' place of any period Roman numerals for 1 to 2000
DDITION	Algorithm, three-digit addends, four-digit sums Algorithm with three addends Add amounts of money, sums less than $50.00 Add decimal tenths	Algorithm, four-digit addends Algorithm, three or more addends Add decimals, to hundredths Round addends, estimate sum; compute result and compare sums Add amounts of money Add proper or mixed-form fractions with like denominators, regrouping for whole-number sums	Algorithm, five-digit and six-digit addends Algorithm, three or more addends Add decimals, to thousandths Round addends, estimate sum; compute result and compare sums Add amounts of money Add proper or mixed-form fractions with like denominators, regrouping
UBTRACTION	Algorithm, four-digit minuends, three-digit differences Check by addition Subtract amounts of money, minuends less than $50.00 Subtract decimal tenths	Algorithm, four-digit minuends, four-digit subtrahends Check by addition Subtract decimals, to hundredths Subtract amounts of money Subtract proper or mixed-form fractions with like denominators, regrouping of whole-number minuends	Algorithm, five-digit and six-digit minuends Subtract decimals, to thousandths Round and subtract to estimate the difference; compute difference and compare with estimate Subtract amounts of money Subtract proper and mixed-form fractions with like denominators, regrouping
ULTIPLICATION	Basic facts Write multiplication sentences Order of factors Related multiplication, division facts Algorithm, two-digit multiplicand, one-digit multiplier	Algorithm, multiplicand to three digits, multiplier to two digits Multiply up to four one-digit numbers Determine missing factor in multiplication fact Multiply one-place decimal by one-digit whole number Round three-digit multiplicand in its greatest place and multiply by one-digit multiplier to estimate product Round decimal multiplicand to nearest whole number and multiply to estimate product Multiply amounts of money Identify multiples of numbers	Algorithm, multiplicand to five digits, multiplier to three digits Identify prime numbers, prime factors, common multiples of a pair of whole numbers Round factors, estimate product; compute product and compare with estimate Multiply decimal tenths, hundredths, thousandths by whole numbers Multiply decimal tenths by decimal tenths Round decimal factor(s) to whole number(s) and multiply to estimate product(s) Multiply amounts of money Multiply a fraction and a whole number which is a multiple of the denominator Find equivalent fractions, ratios, rates
IVISION	Basic facts Write division sentences Related division, multiplication facts Introduction to algorithm, remainders	Algorithm, to three-digit dividend, one-digit divisor Check by multiplying Divide whole-dollar amounts Find average of set of numbers	Algorithm, dividend to six digits, divisor to two digits Check by using multiplication Round dividend, divisor to estimate quotient; compute quotient and compare with estimate Divide to thousandths by one-digit or two-digit whole numbers Divide amounts of money Find equivalent fractions, ratios, rates Find decimal equivalent to a fraction Find average of set of numbers and compare it with the given numbers

Scope and Sequence

	Grade 3	Grade 4	Grade 5
DECIMALS AND FRACTIONS	Mixed form with halves, thirds, fourths, tenths for wholes and parts of wholes Halves, thirds, fourths, tenths of a set Decimal tenths and hundredths of a whole Place value for decimal tenths Compare, order decimal tenths Add, subtract decimal tenths	Proper and mixed-form halves, thirds, fourths, fifths, tenths, hundredths for part-of-whole and part-of-set models Equivalent decimal tenths, hundredths with part-of-whole model Place value for decimals to hundredths; regrouping Equivalent decimals and proper and mixed-form fractions (100, 10, 4, 2 as denominators) Compare, order decimals to hundredths Add, subtract decimals, to hundredths Multiply one-place decimal by one-digit whole number Round decimal to nearest whole number, estimate sum or product Compare and order fractions using decimal equivalents and models Add, subtract proper or mixed-form fractions with like denominators, regrouping to/from whole numbers	Proper and mixed-form fractions for part-of-whole, part-of-set models Decimal thousandths Equivalent decimal tenths, hundredths, and thousandths Place value for decimals to thousandths; regrouping Compare, order decimals to thousandth Round decimal to nearest whole numb to nearest tenth Add, subtract decimals, to thousandths Multiply decimal tenths, hundredths, thousandths by whole number Multiply decimal tenths by decimal tenths Round decimal factor(s) to whole number(s) and multiply to estimate product(s) Divide decimal by whole number, "terminating" quotients Find equivalent fractions Find the missing term in a pair of equivalent fractions Compare fractions (one denominator not necessarily a multiple of the oth Convert between decimals and fraction (halves, fourths, fifths, eighths, tenth Convert between improper fractions and mixed-form fractions Add, subtract proper and mixed-form fractions with like denominators, regrouping Multiply a fraction and a whole number which is a multiple of the denominator
PROBLEM SOLVING	Draw pictures and diagrams Multiple-step solutions; addition, subtraction, comparison Write concluding statements Identify relevant, irrelevant, missing information Guess and test Multiple solutions Recognize answers as reasonable	Use models to obtain solutions Choose the operation needed Identify relevant, irrelevant, missing information Write an equation for a word problem Multiple-step solutions; addition, subtraction, multiplication, comparison Estimate answers Recognize answers as reasonable Guess and test Multiple solutions Read scales Organize data Logical thinking	Identify relevant, irrelevant, missing information Recognize that different situations affect answers Find the number of possibilities Collect, organize, and display data Give the most reasonable answer Use models to obtain solutions Write, solve an equation for a word problem Multiple-step solutions; addition, subtraction, multiplication, division, comparison Find patterns Estimate answers Recognize incorrect results Logical thinking Guess and test Multiple solutions Use a calculator
MEASUREMENT	Read, record time to the nearest minute Use a calendar to identify dates Measure in centimetres, decimetres, to the nearest unit Estimate and measure in centimetres, decimetres, metres Convert between decimetres and centimetres; centimetres and metres	Estimate and measure; choose the preferred linear unit Convert between kilometres and metres; metres and centimetres Measure and add to find perimeter Count, estimate, and calculate the number of centimetre squares; give area in square centimetres Count, estimate the number of square centimetres	Estimate, measure and record lengths in appropriate units Convert among millimetres, centimetres, and metres Multiply to find perimeter of a square; multiply and add to find perimeter of a rectangle Measure distance around circular objects Multiply to find area of a rectangle

	Grade 3	Grade 4	Grade 5
ASUREMENT ntinued)	Express metres, decimetres, and centimetres with decimals Estimate and measure capacity in litres Estimate and measure mass in kilograms Introduction to kilometres, grams, and millilitres Measure and compare temperatures Find perimeter by measuring Count centimetre squares; give area in square centimetres Count centimetre cubes; give volume in cubic centimetres	Calculate area in square centimetres, square decimetres, or square metres Count, estimate the number of centimetre cubes; compare objects to centimetre cube, decimetre cube, metre cube Compare small amounts of time, of length, of mass, of capacity Classify capacities in comparison with 1 mL, 500 mL, 1000 mL Classify masses in comparison with 1 g, 500 g, 1000 g Convert among units of time; choose preferred unit of time Tell and record time to the nearest minute using 12-hour and 24-hour clock; add, subtract time using 24-hour clock	Create rectangular shapes having given perimeter or area Count, calculate the number of centimetre cubes; give volume in cubic centimetres Investigate metric prefixes Estimate capacity in millilitres, litres Estimate mass in grams, kilograms Convert between millilitres and litres, grams and kilograms Find capacity in litres, millilitres, by finding volume in cubic centimetres Convert among volume, mass, and capacity units for water Numeric dating; time to the second; add, subtract time, no regrouping Measure, classify, and draw angles
OMETRY	Recognize similar shapes Recognize, draw, compare line segments Identify and name triangles, rectangles, squares, pentagons, hexagons, octagons Recognize cubes, prisms, pyramids, cones, cylinders, spheres Count faces, edges, vertices Create slide, flip, or turn images; patterns Identify and show lines of symmetry; create shapes having line symmetry	Identify, name, and draw lines, line segments and their end points Identify, name, and draw angles; identify and draw right angles Compare angles to right angles Identify, name, and draw triangles; identify and name sides and angles of triangles Identify and draw polygons; identify and name sides and angles of polygons Identify and draw circles; identify and name parts of circle Recognize patterns for, and properties of, solids Use tracing paper to test for congruency in general and under a slide, flip, or turn on a grid Identify and check line of symmetry as a flip line; identify multiple lines of symmetry (on a grid)	Identify, name, and draw lines, rays, and line segments Identify and draw parallel, intersecting, or perpendicular lines, rays, and line segments Identify, name, measure, and draw angles; identify congruent angles by tracing Classify angles as acute, right, or obtuse Classify plane shapes according to number of sides, relationships between sides and lines of symmetry; equilateral, isosceles, and scalene triangles; square, rhombus, rectangle, parallelogram, trapezoid Classify pyramids and prisms according to their faces Recognize cylinders, spheres, cones Identify and sketch lines of symmetry (not on grid) Use tracing paper to test for or help draw slide, flip, or turn image (on or off grid) Turn triangles to form regular polygons Fit polygons together to make a pattern without spaces Copy picture from one grid onto another grid (including distortions)
APHING	Gather and organize information in bar graphs Create and interpret pictographs Associate ordered pairs of numbers and points on a grid Complete line graphs	Interpret pictographs and bar graphs Gather and organize information in pictographs and bar graphs Associate ordered pairs of numbers (including 0 as a coordinate) and points on a grid	Interpret pictographs and bar graphs Gather and organize information for pictographs and bar graphs Relate graphing of ordered pairs of numbers to graphing of ordered pairs of data Interpret and draw line graphs
TIO D RCENT			Write ratios using colon and fraction notation Multiply, divide to find equivalent ratios, rates Find the missing term in a pair of equivalent ratios, rates Use the symbol % for percent Convert among ratios, decimals, and percents

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The Mathematics Centre

A mathematics centre, like centres for other subject areas, is a place for the storage of certain specific materials and an area for the students to become involved in activities. With careful planning and involvement of the students, the mathematics centre can become a stimulating environment. The students will enjoy bringing materials from home to supplement and add variety to those in the centre. The mathematics centre is an ideal place to display the students' work. If a thematic approach is used for teaching mathematics, the centre can be adapted as a setting for each new theme.

When the students have finished their regular assignments, they may engage in extra activities and projects in the mathematics centre. Activity cards, puzzles, games, and homemade as well as commercial materials will lead the students to broader understanding as well as provide opportunities for the teacher to observe and question the students, and to evaluate their progress. Consideration of the students' interaction in the mathematics centre will suggest adaptations to make this strategy an important part of the learning experience.

STORAGE OF MATERIALS

Materials should be stored where students can have easy access to them. Open shelves and small tables can be used in a pleasing and practical arrangement for holding containers. Containers for materials should be both sturdy and colorful. Vinyl coverings, spray enamel, wallpaper, and fabric will increase the durability of the containers as well as increase the appeal of the mathematics centre. Some ideas for suitable containers are pails (formed by cutting the top off a large plastic bottle), trays (from corrugated boxes in which canned goods are sold), baskets (in which fruit and vegetables are sold), boxes (sturdy ones such as those from small appliances), and other containers (ice cream containers, large cans, plastic tubs).

MATERIALS

The materials used for teaching mathematics need not be expensive commercial materials; simple everyday objects can be used effectively as learning and teaching aids.

A list of the materials suggested for each unit is given in the unit overview. When a unit is almost completed, look ahead to the next unit and begin to collect and have the students help to collect the materials.

The following materials will be helpful for developing the various concepts and skills.

Number

- counters such as buttons, beans, pebbles, bingo chips
- objects for grouping, such as pipe cleaners, drinking straws, stirrers, beans in plastic bags, Unifix cubes
- models for ones, tens, hundreds, and thousands
- flash cards for basic addition, subtraction, multiplication, and division facts
- dominoes and domino cards, playing cards, dice
- shapes marked to show halves, thirds, fourths, fifths, and tenths of a whole
- set holders such as plastic tubs, egg cartons, plastic hoops, Styrofoam trays, paper or foil plates
- models for tenths and hundredths

Geometry

- a collection of three-dimensional shapes, such as balls, boxe cores from rolls of paper, funnels
- wooden, plastic, or cardboard plane shapes (triangl rectangles, squares, pentagons, hexagons, octagons, circle
- commercial wooden or plastic plane shapes (triangl rectangles, squares, pentagons, hexagons, octagons, circle
- geoboards, rubber bands, geopaper from page T 366
- parquetry blocks, gummed shapes for forming patterns
- pictures of symmetrical objects and shapes
- cutouts of plane shapes for showing slides, flips, and turn
- felt, plastic, or cardboard tangram pieces
- materials for constructing models of three-dimensional shap (straws, pipe cleaners, toothpicks, plasticine, clay)
- square tiles (ceramic tiles, floor tiles)
- samples of fabric and wallpaper designs
- centimetre cubes, decimetre cubes

Measurement

- real money, play money, cutouts from pages T 351 and T 3
- non-standard units for measuring length (straws, paper cli ribbons), capacity (jars, paper cups, milk cartons), m (washers, plasticine balls)
- unmarked metre sticks, metre sticks and tapes marked millimetres, centimetres, and decimetres
- rulers or straight edges, wall chart for measuring heights
- containers for comparing capacity (jars, bottles, cans, boxe
- materials for filling containers (sand, water, rice)
- one-litre containers, other containers marked in litres (ju cans, pails) and in millilitres (soft-drink cans, canned goo
- objects for comparing masses (pebbles, stones, books)
- one-kilogram masses, objects with masses marked in ki grams (boxes of detergent, bags of sugar) and in grams (bo of cereal, pasta, or crackers)
- balance scales, kitchen scales, step-on scales

There are many other teaching aids that will be useful i mathematics program, for example, D-Stix, Multibase Arithm tic Blocks. They may be acquired over a number of years, the following aids are basic for the activities suggested in t book.

Display Board: This may be a flannel board, a magne board, or a bulletin board for use with cutouts of objec numerals, and symbols in demonstrating new concepts.

Attribute Blocks: These are sets of wooden or plastic blo that show likenesses and differences in color, shape, size, a thickness. One set usually includes 48 pieces made up of f shapes (circle, rectangle, square, triangle), three colors (r blue, yellow), two sizes, and two thicknesses. (Some sets a include the hexagon.)

If commercial attribute blocks are not available, you m wish to make your own blocks by using the patterns on pa T 353 to T 356. The blocks may be made from plywood of t thicknesses, one of which is about three times as thick as other.

Number Line: A number line on the chalkboard or disp board may be permanently displayed at a level where stude can see it and also reach it, if necessary; for example, w number strips in showing extensions of basic addition fa Each student should have an individual number line.

Other teaching aids are described on pages T 344 and T 34

ming Schedule

he following information will guide you in planning your edule for working through *Starting Points in Mathematics 4* ne year. Depending on the abilities of the students in your s, you will find sufficient material in Book 4 for a minimum gram, an average program, and an enriched program.

or this book, most lessons are developed over two pages and e are referred to as "double page" lessons in the table w. There are also several "single page" lessons, for mple, most *Checking Up* lessons that appear at the end of n unit.

here are approximately 175 days in the school year. The nber of lessons in Book 4 is 175. This number excludes the cking Skills exercises provided after the *Checking Up* pages Units 4, 7, 9, and 12. No suggestions have been made for e and other maintenance lessons because the need for these be determined only by you for the students in your particular s.

he number of days required to complete a unit will depend he level of the students in your class. For example, students have completed the first three books of *Starting Points in hematics* may be able to complete Unit 1 in 16 days or fewer n 16 days. If much of the work is new for students, you may plan to spend as many as 18 to 20 days to consolidate most of the concepts of Unit 1 at this time. Other alternatives would be to omit certain lessons and teach them at a later time. For example, the lessons on fractions in Unit 1 may be delayed until Unit 4 (geometry) and taught effectively at that time when manipulative work with plane shapes is involved. The work on five-place and six-place numerals on pages 18-21 may be left until the lessons in Unit 10 which involve products having more than four digits. The work of ordinal number concepts and Roman numerals can provide a welcome diversion during Unit 5 (multiplication), Unit 6 (division), or Unit 8 (decimals).

Since the work of Units 2 and 3 will likely be review for most students, you may plan to begin the program with these units. At the same time the work of Unit 1 may be introduced gradually. In this way students will have ample opportunity to practice skills with which they are already familiar and still be provided with the challenge of learning new concepts.

Teachers wishing to provide a minium program may plan to omit part or parts of certain units and, depending on the students' progress, return to some of these later in the year. In planning any schedule, it should also be kept in mind that certain topics such as measurement (Units 9 and 12) and geometry (Units 4 and 7) require more time than others as they involve more activity with concrete objects and manipulative materials.

Unit	Number of Lessons		Lessons in Unit	Number of Days	My Schedule
	Dougle Page	Single Page			
1	14	2	16	13 — 20	
2	9	2	11	9 — 12	
3	9	4	13	11 — 15	
4	8	2	10	9 — 12	
5	15	4	19	17 — 21	
6	9	2	11	10 — 13	
7	11	2	13	12 — 15	
8	13	4	17	15 — 19	
9	7	9	16	13 — 18	
10	10	2	12	11 — 14	
11	9	4	13	11 — 15	
12	7	6	13	10 — 14	
13	5	6	11	9 — 12	
Total	126	49	175	150 — 200	

Unit 1 Overview

Numeration

This unit deals primarily with three systems of numeration which students require at this stage of their mathematical development: the base-ten Hindu-Arabic system, Roman numerals, and common fractions. First, the place values of the base-ten system are extended to thousands, with numerals having up to six digits. Both the standard form and the expanded form are included. Then, methods for comparing and ordering numbers are developed with attention directed to digits in the same place-value positions. Rounding numbers to the nearest ten, hundred, or thousand is presented as a foundation for developing skills of estimation in later units. Ordinal numbers are extended to numbers in the hundreds. Roman numerals are examined and students read and write the numerals for numbers to one hundred. Work with fractions reviews the concepts and notation to represent parts of a whole and parts of a set for halves, thirds, fourths, fifths, and tenths. The work with fractions finishes with mixed numerals to represent fractions greater than one.

The last lesson in each unit of this book deals with a specific problem-solving skill. In this unit, non-mathematical situations are presented in which insufficient information is provided. These are drawn from everyday life and are typical of real-life problems in which more information is required before decisions can be made.

Prerequisite Skills

- read and write standard numerals for numbers to 99
- understand ordinal numbers to *thirtieth*

Unit Outcomes

- read and write standard numerals and words for numbers to 999 999
- interpret place value in numerals to 999 999
- write the expanded form for numbers to 999 999
- compare and order numbers to 999 999
- round numbers to the nearest ten, hundred, or thousand
- read and write numerals and words for ordinal numbers to *nine hundred ninety-ninth* and use these numbers to identify positions
- read and write Roman numerals for numbers to 100
- read and write numerals for fractions less than one and mixed numbers less than ten for part of a whole and part of a set (halves, thirds, fourths, fifths, tenths)
- draw diagrams to illustrate fractions less than one for part of a whole and part of a set
- determine additional information that may be required to solve a problem

Background

There are two aspects for any number, the *cardinal* concept and the *ordinal* concept. The cardinal concept of number is based on an understanding of how many there are in a set (one, two, three, . . .), whereas the ordinal concept is based on identifying the position of a single member of the set (first, second, third, . . .) when the members of the set are arranged in sequence. Most everyday uses of numbers and their numeration relate to their cardinal concepts. The ordinal concepts are less frequently encountered but are, nevertheless, important. Fo instance, the number on a sales slip is an ordinal number since identifies one sale in a sequence of consecutive sales, rather tha the total number of sales to that time.

The words *number*, *numeral*, and *digit* are encountered bo formally and informally in this unit. Confusion often arises as their correct usage. Briefly, a number is an abstract ide whereas a numeral is any symbol or arrangement of symbols th represents a number. A digit is a single symbol, and in th Hindu-Arabic system, the ten digits required are 0, 1, 2, 3, 4, 6, 7, 8, 9. The number concept "three" can be represented by which is both a numeral and a digit, and by expressions usin several symbols, for example, $2 + 1$, $5 - 2$, and $6 \div$ Numbers greater than nine require two or more digits, such as and 5 to represent "twenty-five" as 25. It is correct to ask student to write the *numeral* for twenty-five since one cann write a *number*. On the other hand, we add numbers, n numerals. While teachers are encouraged to use these wor correctly, they are also cautioned against making an issue of th correct usage with students. Students usually have an intuitiv understanding of the terms *number* and *numeral*, and raising th issue may create more confusion than clarification. In general, there is doubt as to which word should be used, use the wo *number*.

Showing numbers in expanded form reinforces the concept place value since the total value of each digit (except 0) in th numeral is clearly expressed, as seen in the following examples

Standard Form	Expanded Form
384	300 + 80 + 4
2630	2000 + 600 + 30
4097	4000 + 90 + 7

As stated earlier, for the base-ten numeration system, two more digits are needed to represent numbers greater than nin This is accomplished with grouping by tens. The number groups of ten ones is represented by a digit in the *tens' place* (the left of the ones' digit). The number of groups of ten tens represented by a digit in the *hundreds' place* (to the left of th tens' digit), and so on. The position of a digit, then, is importa since it determines the value of a digit. In other words, a dig has both "face value" and "place value". The digit 2 in 32 h a face value of 2 and a place value of one, making a true value "two". In 23, the 2 has a face value of 2 and a place value ten, making a true value of "twenty". In 203, since the digit 2 in the hundreds' place, its true value is "two hundred". Th importance of 0 as a place holder cannot be overemphasized. F example, using 0 with 2 and 3 gives numerals for differe numbers — 230, 203, and 23 (023).

In contrast to our Hindu-Arabic numeration is the Rom system. In our place-value system the ten digits may appear any position and their true values depend as much on the placement as on their own value. In the Roman syste however, place value is not used and numbers from one to o hundred are represented by the symbols I, V, X, L, and C in variety of combinations and positions. Position is important if symbol of lesser value precedes one of greater value, in whi case their difference is the true value of the expression. F example, IV represents "one and five", but since the less value is on the left, the number represented is their differenc namely, "four". Similarly, XL represents "forty" (ten le than fifty). In all other instances, the values are add progressively from left to right. For example, in XCVIII, X

presents "ninety" (ten less than one hundred) and the number presented by XCVIII is then "ninety plus eight", or ninety-eight".

aching Strategies

Although the students at this stage have previously worked th abstract number concepts and numeration for several years, is important that they acquire a good understanding, rticularly as they proceed to work with greater numbers, often yond their everyday experiences. Students need opportunities use concrete materials such as base-ten Multibase Arithmetic ocks (similar to those illustrated on page 6), Unifix cubes, rdboard strips and squares, counters, sticks, or straws bundled groups of ten. Keep in mind that some students need to see veral different place-value models to acquire meaningful ncepts. An abacus is also an effective aid and numbers up to 9 999 may be examined if two three-place abaci are placed le by side, with the one on the left representing thousands. ace-value pocket charts are also valuable devices to strengthen mber concepts. When two place-value pocket charts are aced side by side as shown on page T 344, emphasis is placed each *period* (group of three digits). For example, in the meral 365 214 the first period is 214 and the second period is 5. The first period is called the ones' period because the mber represented by its digits is that many ones. The second riod is called the thousands' period because its digits represent ousands.

While the learning process begins in the concrete experi- ce, the teacher must be instrumental in assisting the student to aw out the concept, to consolidate it, and to internalize it. This t step will require considerable practice and drill, frequently ore than can be provided within the confines of a textbook. To sist the teacher, various games and/or related activities are ovided for each lesson.

The adoption of the metric system of measurement has led to increased emphasis on decimals and a decreased emphasis on actions. Nevertheless, an understanding of basic fraction ncepts and standard notation is necessary. Students need portunities to fold, cut, and color shapes to show the various action parts, and to become familiar with fraction names and merals. In preparation for an early introduction of decimal ncepts, pay particular attention to the teaching of tenths.

Much of the work in Unit 1 will be new for the students of your ass. You may wish to cover only a portion of Unit 1 for the esent and, at the same time, carry out a review of basic dition and subtraction facts. In this way, students will still be ovided with the challenge of learning new concepts while acticing skills with which they are already familiar. For ample, you might plan to cover only pages 2-15, page 30, and propriate exercises from page 31 (*Checking Up*) in Unit 1. For change of pace, review basic addition and subtraction facts by signing exercises from pages 32 and 33 of Unit 2 and pages 52 d 53 of Unit 3. The balance of Unit 1 may be taken later in the ar according to each teacher's choice. For example, the work fractions (pages 24-29) may be included in a study of o-dimensional shapes during the study of geometry (Unit 4). he work of ordinal numbers and Roman numerals may provide welcome diversion during the study of multiplication (Unit 5) d division (Unit 6). Since addition and subtraction exercises in is book do not extend beyond four-digit sums and minuends, ges 18 to 21 of Unit 1 (numbers to 999 999) may be delayed til five-digit products are encountered in Unit 10.

Materials

blank card for each student (about 15 cm in length)
models for thousands, hundreds, tens, and ones
four paper bags, each labeled with one of the words *thousands*, *hundreds*, *tens*, *ones*
four sets of nine numeral cards, one set for each of the multiples of 1000 (to 9000), the multiples of 100 (to 900), the multiples of 10 (to 90), and the multiples of 1 (to 9)
one peg abacus (see page T 344) for each of several small groups of students
play money, or cutouts of the bills from page T 352
old magazines, newspapers, books
copy of page T 367 for each student
two place-value pocket charts showing hundreds, tens, ones, one chart labeled *thousands* (see pages T 18 and T 344)
several six-place numeral cards as described in *Before Using the Pages* on page T 20
15 toothpicks for each student
pictures of the flags for the ten provinces of Canada and for different countries of the world
display board; shapes showing halves, thirds, fourths, fifths, and tenths; shapes showing 2, 3, 4, 5, and 10 unequal parts
cutouts for wholes and parts of a whole
small objects for showing sets
several identical containers (small boxes, paper cups)
overhead projector, acetate, copies of page T 348
books showing page numbers in Roman numerals

Vocabulary

digit
numeral
standard form
expanded form
abacus
dollars
amount
kilometres, km
tally
fraction
collector
sculpture
customer
thousands, hundreds, tens, ones
ten thousands, hundred thousands
place-value chart
is greater than, is less than
greatest, least
rounding
rounded to
nearest ten
nearest hundred
nearest thousand
ordinal number
Roman numerals
names of the provinces of Canada

number names *zero* to *nine hundred ninety-nine thousand nine hundred ninety-nine*
ordinal names *first* to *nine hundred ninety-ninth*
names of fractions less than one and mixed numbers less than ten for halves, thirds, fourths, fifths, tenths
names of the cities identified on the map of Canada on pages 20 and 21

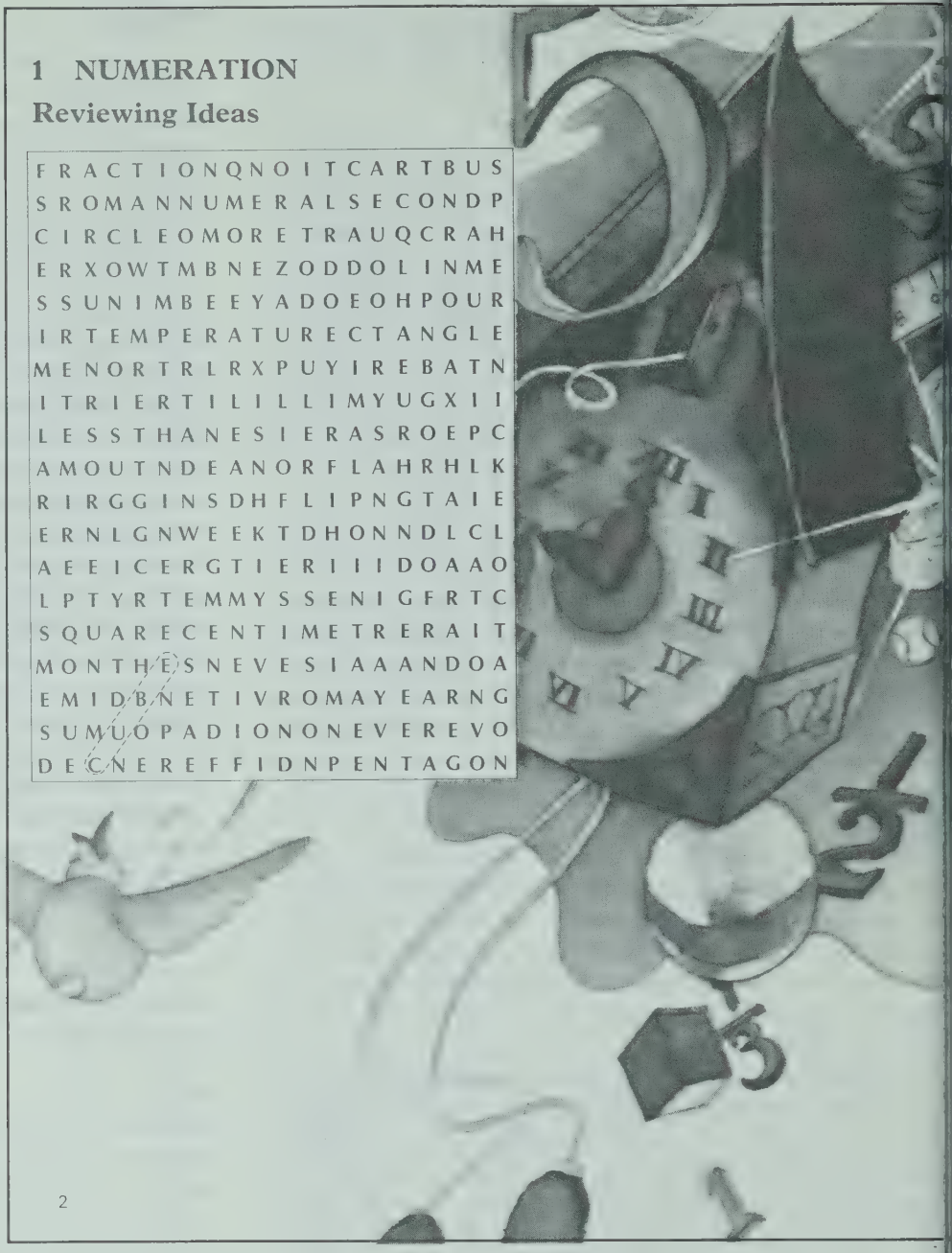
Pages 2-3

OBJECTIVE

Recall concepts and words learned in mathematics

Materials

model of a cube (optional); blank card (about 15 cm in length) for each student; a list of some or all of the words on page T348, a sheet of acetate, and three or four paper clips for each student (optional); a copy of the puzzle on acetate and an overhead projector (optional)



LESSON ACTIVITY

Using the Pages

- The purpose of this lesson is to reacquaint students with mathematical concepts and words from their previous work in mathematics. The illustration on the pages and the words discovered in the puzzle can stimulate discussion about aspects of number, measurement, and geometry. The discussion can help you determine the students' degree of familiarity with terms associated with these topics. The concepts identified in the puzzle will be met again as students work through the units of the text. Thus, this lesson can offer a review of concepts met in the past and a preview of those that will be extended during the year.

  Have the students examine the illustration and encourage them to tell about the symbols, numerals, shapes, and so on, that they recognize. Use the information on page 3 to help students understand how words are shown in the puzzle. You might, for example, have a model of a cube in the classroom. Have a student identify it and then direct the discussion to the properties of a cube. The fact that the fla surfaces of a cube are identical square faces can lead to search for the words *square* and *face* in the puzzle. I necessary, direct the students to the fifteenth row of th puzzle to find the word *square*. They may then notice th word *centimetre* in the same row.

  Locating the word *face* is more of a challenge. Have th students count over to the seventeenth column and then u six rows. The word should be easy to locate from this clue.

  To help locate words in the puzzle, give each student blank card about 15 cm in length. The card can be used t align the letters of a row, column, or diagonal. A systematic search for words is probably the best approach That is, have the students examine the puzzle row by rov first, then column by column, and finally diagonal b diagonal, using the card as a guide. Remind the student that the order of the letters of a word may be reversed, fo example, "NOITCARTBUS" for *subtraction* in the firs row. Have the students write each word in a list as it i found. Later, the words in the list may be discussed.

Some of the words you learned in mathematics are hidden in this puzzle.
They are written forward and backward, up and down, across, and diagonally.
I see the word "cube".
I remember what a cube is.
How many of the words can you find in the puzzle?
How many ideas do you remember?
Possible words are listed on page T348.
3

RELATED ACTIVITIES

- Words discovered in the puzzle may be listed under different headings, such as *Number*, *Measurement*, and *Geometry*. Under each heading, words may be grouped together according to topic; for example, words related to addition or words related to measurement of length.
- Students may show examples to illustrate the meanings of words found in the puzzle, such as *fraction*, *Roman numeral*, *circle*, *odd* (number), *even* (number), *array*, and *hexagon*.
- Students may be interested in helping to prepare a display to show the meanings of words found in the puzzle. The display can be developed around the topics *number*, *measurement*, and *geometry*. Students may draw pictures or cut examples from newspapers and magazines to illustrate the various concepts.

Depending on the students in your class you may prefer one or more of the following approaches.

1. Have students work in small groups rather than individually.
2. Provide students with a list of the words they are to find (see page T348). As each word is located in the puzzle, a check may be shown beside the word in the list.
3. Provide each student with a sheet of acetate and three or four paper clips to keep the acetate in position over the puzzle on page 2. Have the students draw rings on the acetate to show the words that they have found.
4. Prepare a large copy of the puzzle on a sheet of acetate. Use the overhead projector to project the puzzle on the board. Have students, in turn, ring words on the board.
5. Prepare a large copy of the puzzle on a sheet of Bristol board or on a sheet of squared paper. Have students, in turn, ring words that they can identify.

Pages 4-5

LESSON OUTCOME

Read and write standard numerals for numbers to 999; interpret place value in numerals to 999

Materials

models for hundreds, tens, and ones

Vocabulary

names for numbers to 999, ones, tens, hundreds, digit, numeral, standard form

Prerequisite Skills

Read and write standard numerals for numbers to 99

Checking Prerequisite Skills

Match the word with the numeral.

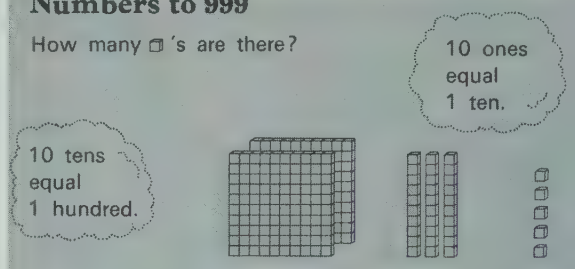
1. 47 — forty-seven
2. 6 — six
3. 80 — eighty
4. 29 — twenty-nine

Write the numeral for each.

5. sixty-three 63
6. ten 10

Numbers to 999

How many ▢'s are there?



2 hundreds 3 tens 5 ones

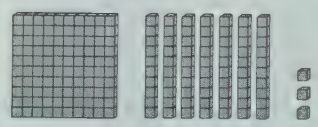
200 30 5

hundreds	tens	ones
2	3	5

There are 235 ▢'s.

235 is the **standard form** for *two hundred thirty-five.*

Working Together



For the picture,

1. how many hundreds? 1
2. how many tens? 7
3. how many ones? 3
4. how many in all? 173

Write the standard form for each.

	hundreds	tens	ones	
5.	4	6	7	467
6.	six hundred	twenty-two		622
7.	two hundred	nine		209
8.	five hundred	seventy		570

What does each digit mean in these numerals?

9. 236
10. 472
11. 105
12. 380

9 2 hundreds 3 tens 6 ones
10 4 hundreds 7 tens 2 ones
11 1 hundred 0 tens 5 ones
12 3 hundreds 8 tens 0 ones

4

LESSON ACTIVITY

Before Using the Pages

- Use models of ones and tens and a place-value chart to represent numbers to 99. Review that numbers to nine are written as one-digit numerals, and numbers from 10 to 99 are written in standard form as two-digit numerals. Establish that 10 ones are equal to 1 ten. Discuss the significance of each digit in the numeral, for example, 32 indicates 3 tens and 2 ones. Include a discussion of pairs of numbers such as 24 and 42.

tens	ones	standard form
2	4	24
4	2	42

- Represent 99 using the models. Ask what number is one greater than 99. Discuss that "one hundred" may be represented by 100 ones, or 10 tens, or 1 hundred. Display a model for 100 and have a student write the numeral on the board in a place-value chart and in standard form.

Using the Pages

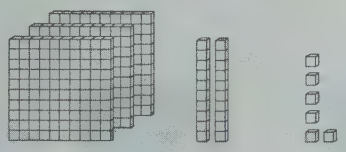
- The two illustrated examples help to establish that numbe from 100 to 999 are written in standard form as three-di numerals. These indicate a number of ones, a number tens, and a number of hundreds, in that order from right left. The example on page 4 emphasizes that 10 ones equ 1 ten and 10 tens equal 1 hundred. The total number small cubes is determined from the number of groups one hundred cubes, the number of groups of ten cubes, a the number of single cubes. Discuss that grouping the cub in hundreds, tens, and ones facilitates counting the cub and writing the numeral. Point out that the numeral h three digits. Use this example to show the similarity of t word name *two hundred thirty-five*, the number express in the form 200 30 5, and the standard numeral 235.

  The example on page 5 emphasizes the place value each digit in the numeral. It also provides an opportunity discuss the difference in meaning between the 2 in 326 a the 2 in 235, and similarly, the digit 3 in each numera Draw attention to the terms *digit* and *standard form*.

What does each **digit** mean in the numeral 326?

three hundred twenty-six

hundreds	tens	ones
3	2	6



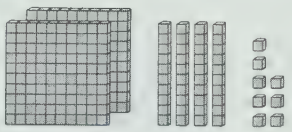
3 hundreds 2 tens 6 ones

300 20 6

The 3 in the hundreds place means 3 hundreds.
The 2 in the tens place means 2 tens.
The 6 in the ones place means 6 ones.

Exercises

For the picture,



1. how many hundreds? 2
2. how many tens? 4
3. how many ones? 8
4. how many in all? 248

Write the standard form for each.

	hundreds	tens	ones	
5.	7	1	3	713
6.	3	9	6	396
7.	9	0	1	901
8.	5	3	2	532

9. four hundred thirty-two 432
10. six hundred four 604
11. eight hundred seventy 870
12. nine hundred sixteen 916

What does the 8 mean in each numeral?

13. 218 **14.** 483 **15.** 817 **16.** 582 **17.** 708 **18.** 822
19. 280 **20.** 458 **21.** 891 **22.** 486 **23.** 928 **24.** 888

13. 8 ones 14. 8 tens 15. 8 hundreds 16. 8 tens 17. 8 ones
18. 8 hundreds 19. 8 tens 20. 8 ones 21. 8 hundreds
22. 8 tens 23. 8 ones 24. 8 hundreds 8 tens 8 ones

RELATED ACTIVITIES

- Oral exercises conducted in small groups can be helpful in familiarizing students with the mathematical terms and concepts of this lesson. For example, have students select any page of the text, read the page number, tell the number of digits in the numeral, name the ones' digit, and so on.
- Play "I am thinking of a number" in small groups. For example, say, "The tens' digit is 6. The ones' digit is 3. What is the number?" or "The numeral has two digits. The tens' digit is 5. Is more than one number possible?"
- Students may use copies of page T 362 to make their own set of models of hundreds, tens, and ones for representing numbers to 999.
- Students who require more experience with concrete materials may work in pairs, using models of hundreds, tens, and ones, an abacus, or a place-value pocket chart (see page T 344). One student names a number less than 1000. The other student represents the number. Students may exchange roles or the order of the procedure may be reversed.
- You may wish to have students write the word names for the numbers in Ex. 13-24.

orking Together: The exercises deal with the following skills.

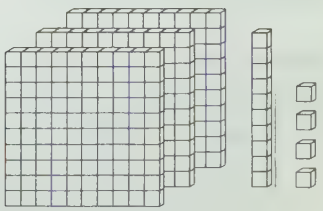
1. Write the standard numeral given a semi-concrete representation of the number (Ex. 1-4), the number of hundreds, tens, and ones (Ex. 5), and the word name (Ex. 6-8).
2. Identify the value of each digit in a three-digit numeral (Ex. 9-12).

Provide extra examples as required. Include numerals for which there is a 0 in the tens' place or in the ones' place, as these examples may require more explanation than others (Ex. 7, 8, 11, 12). Models of hundreds, tens, and ones are helpful in bringing about an understanding of such numerals.

ercises: When the students have completed their work, ask as many of them as possible to read one or more of the numerals in Ex. 13-24. Note that the word "and" is not used in reading the numerals (see Ex. 9-12).

Assessment

For the picture,



1. how many hundreds? 3
2. how many tens? 1
3. how many ones? 4
4. how many in all? 314

Write the standard form for each.

	hundreds	tens	ones	
5.	6	2	8	628
6.	9	3	0	930

7. six hundred five 605

What does the 4 mean in each numeral?

8. 462 **9.** 174 **10.** 345
4 hundreds 4 ones 4 tens

Pages 6-7

LESSON OUTCOME

Read and write standard numerals for numbers to 9999; interpret place value in numerals to 9999

Materials

models for thousands, hundreds, tens, and ones

Vocabulary

thousand

Prerequisite Skills

Read and write standard numerals for numbers to 999; interpret place value in numerals to 999

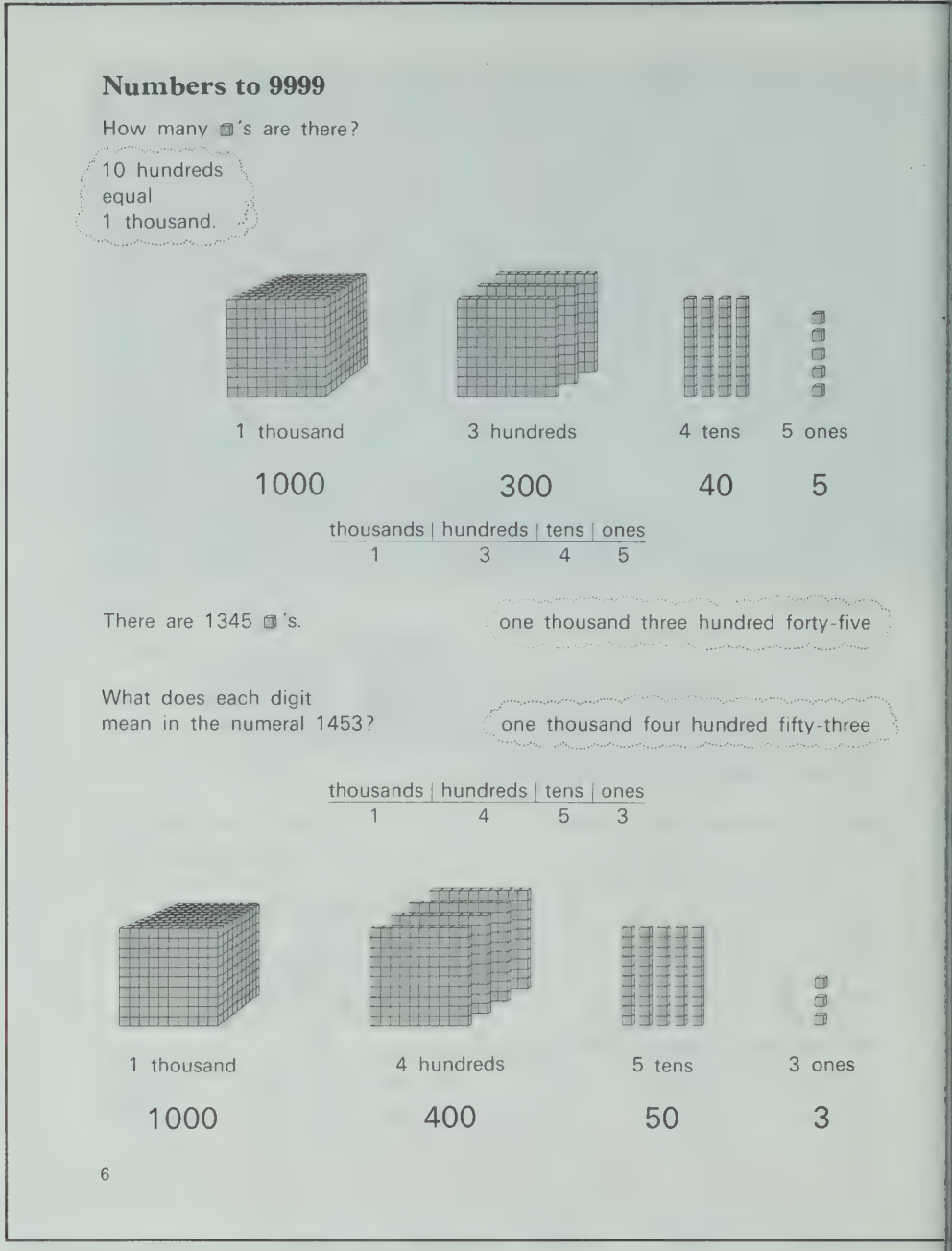
Checking Prerequisite Skills

Write the standard numeral.

1. 6 hundreds 4 tens 7 ones 647
2. five hundred thirty 530
3. two hundred eight 208

What does each digit mean in these numerals?

4. 109 1 hundred 0 tens 9 ones
5. 910 9 hundreds 1 ten 0 ones



LESSON ACTIVITY

Before Using the Pages

- Display models for 9 hundreds, 9 tens, and 9 ones. Ask what number is shown. Have a student write the standard numeral on the board. Review that the numeral has three digits and discuss the meaning of each digit.

  Ask what number is one greater than 999. Discuss that "one thousand" may be represented by 1000 ones, or 100 tens, or 10 hundreds. Display 10 hundreds. Then display a model for 1 thousand as the simplest way of representing the number 1000. Write the numeral in a place-value chart. Ask how many digits the standard numeral has and discuss the meaning of each digit.

thousands	hundreds	tens	ones	
1	0	0	0	1000

  Discuss that 9 is the greatest number that can be shown in each place on the place-value chart. If we add 1 one to 9 ones (in 999), we have 10 ones, so 0 is written in the ones place and 1 (ten) is added in the tens' place. This makes 10 tens, so 0 is written in the tens' place and 1 (hundred) is added in the hundreds' place. This makes 10 hundreds, so 0 is written in the hundreds' place and 1 (thousand) is written in the next place, which is called the *thousands' place*.

Using the Pages

- The examples illustrate that numbers from 1000 to 9999 are written in standard form as four-digit numerals. The value of each digit is emphasized and these values determine the number that is named, in other words, the total number of small cubes. Emphasize that one more place is shown to the left of the hundreds' place, and review the right-to-left significance of the places.

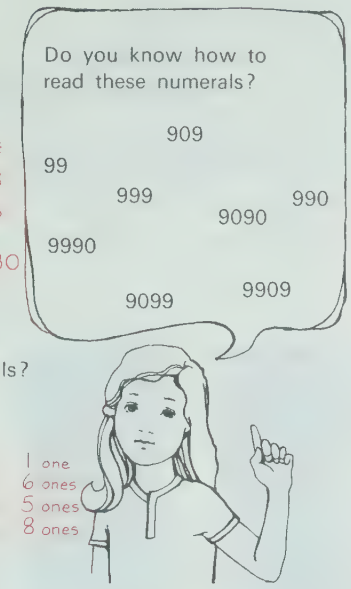
  At this time it may be helpful to represent the two numbers, 1345 and 1453, using the classroom models, particularly if the models differ from those illustrated on the page.

Working Together

Write the standard form for each.

	thousands	hundreds	tens	ones	
1.	3	6	9	4	3694
2.	5	0	1	8	5018
3.	9	8	0	6	9806

4. two thousand seven hundred thirty 2730
5. four thousand fifty-eight 4058
6. six thousand six 6006



What does each digit mean in these numerals?

7. 7241
8. 1056
9. 2105
10. 4008

7 7 thousands 2 hundreds 4 tens 1 one
8 1 thousand 0 hundreds 5 tens 6 ones
9 2 thousands 1 hundred 0 tens 5 ones
10 4 thousands 0 hundreds 0 tens 8 ones

Exercises

Write the standard form for each.

	thousands	hundreds	tens	ones	
1.	2	3	7	2	2372
2.	6	6	0	8	6608
3.	1	0	1	9	1019
4.	8	4	5	0	8450

5. three thousand four hundred fifty-six 3456
6. one thousand ninety 1090
7. nine thousand eleven 9011
8. seven thousand five hundred two 7502

What does the 4 mean in each numeral?

9. 1124 — 4 ones
10. 4306 — 4 thousands
11. 7422 — 4 hundreds
12. 8743 — 4 tens
13. 4908 — 4 thousands
14. 1452 — 4 hundreds
15. 5934 — 4 ones
16. 2046 — 4 tens
17. 3400 — 4 hundreds
18. 1004 — 4 ones
19. 3545 — 4 tens
20. 8424 — 4 hundreds
21. 4417 — 4 thousands
22. 2644 — 4 tens
23. 4404 — 4 thousands

Write the standard form for each.

24. 1 ten, 2 thousands, 3 hundreds, 6 ones — 2316
25. 4 hundreds, 8 ones, 6 tens, 5 thousands — 5468
26. 5 hundreds, 7 ones, 9 thousands, 0 tens — 9507

RELATED ACTIVITIES

- Have each student fold a sheet of paper lengthwise twice and then unfold it. The creases will indicate four columns. Have the students print the words *thousands*, *hundreds*, *tens*, and *ones* as headings for the columns. In any order, name a digit for each of the four columns; for example, four tens, six thousands, zero hundreds, two ones.

thousands	hundreds	tens	ones
6	0	4	2

Have the students write the digits in the appropriate columns. Ask a student to read the number represented by the four digits. Repeat for other examples.

- Students may work alone or in pairs using a set of numeral cards, one card for each of the digits 0 to 9. The cards are placed in a bag or arranged face down. Each student draws four cards and arranges them in as many different ways as possible (24) to obtain four-place numerals.

A written record should be made for each arrangement of the cards.

2341 2413 2134
2314 2431 2143
. . .

orking Together: The skills outlined on page T 5 in *Working Together* for numbers to 999 are extended here to include the thousands' place. Again, it is important to give particular attention to 0 as a place holder. While the students are working you might move around the room and have each student read aloud one or more of the numerals shown at the top right of page 7.

It should be noted that a comma is not used to separate the hundreds' digit from the thousands' digit. In *Using the Pages* on page T 19 it will be discussed that a space is left between the thousands' and the hundreds' digits when writing numerals with five or more digits.

For some students it may be necessary to represent the numbers in Ex. 7-10 using models.

xercises: Note that for Ex. 24-26, the numbers of thousands, hundreds, tens, and ones are named in random order. For example, the number named in Ex. 24 is not 1236 but 2316. Remind the students that no comma is used to separate the hundreds' digit and the thousands' digit in each numeral.

Assessment

Write the standard form for each.

1. 6 thousands
   0 hundreds
   2 tens
   5 ones 6025
2. 4 tens
   3 thousands
   0 ones
   1 hundred 3140
3. nine thousand forty-three 9043

What does the 3 mean in each numeral?

4. 2341 — 3 hundreds
5. 3075 — 3 thousands
6. 3133 — 3 thousands, 3 tens, 3 ones

LESSON OUTCOME

Write the expanded form for numbers to 9999

Materials

four paper bags, each labeled with one of the words *thousands*, *hundreds*, *tens*, *ones*; four sets of nine numeral cards, one set for each of the multiples of 1000 (to 9000), the multiples of 100 (to 900), the multiples of 10 (to 90), and the multiples of 1 (to 9); one peg abacus for each of several small groups of students

Vocabulary

expanded form, abacus

Prerequisite Skills

Read and write standard numerals for numbers to 9999; interpret place value in numerals to 9999

Checking Prerequisite Skills

Write the standard numeral.

1. 2 thousands
9 hundreds
3 tens
6 ones 2936

2. four thousand fifty-seven 4057

What does each digit mean in these numerals?

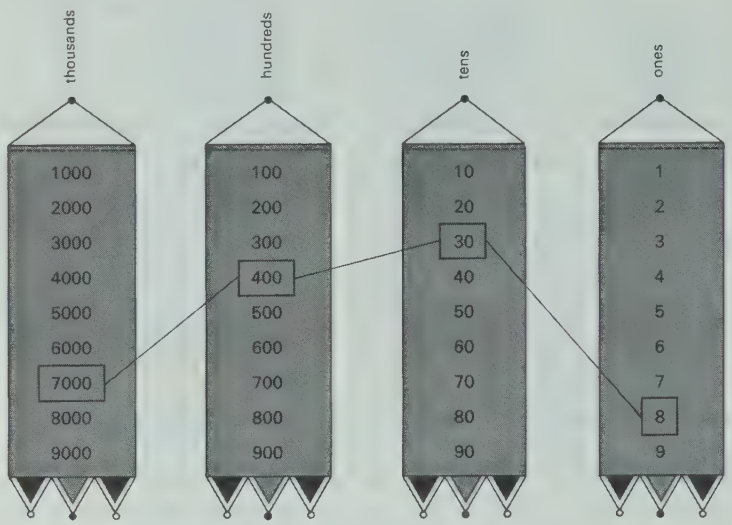
3. 1804 1 thousand 8 hundreds 0 tens 4 ones

4. 3071 3 thousands 0 hundreds 7 tens 1 one

Expanded Form

The numeral 7438 means
7 thousands 4 hundreds 3 tens 8 ones.

thousands	hundreds	tens	ones
7	4	3	8



In **expanded form**,
7438 = 7000 + 400 + 30 + 8.

Working Together

What does the marked digit mean in each numeral?

1. 4721 7 hundreds **2.** 3629 2 tens **3.** 9125 5 ones **4.** 5867 5 thousands

Show the expanded form for each.

5. 1256 1000 + 200 + 50 + 6 **6.** 4209 4000 + 200 + 9 **7.** 3064 3000 + 60 + 4 **8.** 2050 2000 + 50

Show the standard form for each.

9. 5000 + 600 + 30 + 5 5635 **10.** 3000 + 70 + 2 3072 **11.** 1000 + 600 + 10 1610

8

LESSON ACTIVITY

Before Using the Pages

- Label four paper bags, one for each of the words *thousands*, *hundreds*, *tens*, and *ones*. Place numeral cards for multiples of 1000 (to 9000) in the thousands' bag. Place numeral cards for multiples of 100 (to 900) in the hundreds' bag. Place cards for multiples of 10 (to 90) in the tens' bag and cards for 1 to 9 in the ones' bag.

  Have each of four students, in turn, draw a card from a different bag beginning with the thousands, then the hundreds, then the tens, and then the ones. Have them place the cards on a ledge or a flat surface in left-to-right sequence. Read each of the numerals, in turn, from left to right and ask what number is represented. Write the standard numeral on the board and have students name the number of thousands, hundreds, tens, and ones in it. Repeat the activity several times. Include examples for which no card is drawn from one or more bags, but always draw a card from the thousands' bag.

6000	400	20	7	6427
2000	(no card)	50	3	2053
8000	700	(no card)	(no card)	8700

Using the Pages

- Draw the students' attention to the title *Expanded Form*. Discuss that an object such as a rubber band is longer when it is stretched or *expanded*. Remind them that the numeral 7438 shows the standard form, which is the simplest form of numeral for a number. Draw their attention to the expanded form of 7438, and have them observe both the length of the numeral and the three plus signs for 7000 + 400 + 30 + 8.

  Write any four-digit numeral on the board, for example 6251, and ask students to trace a path with their fingers from one banner to the next. Ask which banners would not be used for such numerals as 4502 and 3060.

Exercises

Write the expanded form for each.

1. 9426 9000 + 400 + 20 + 6
2. 7054 7000 + 50 + 4
3. 6804 6000 + 800 + 4
4. 5260 5000 + 200 + 60
5. 2040 2000 + 40
6. 1005 1000 + 5

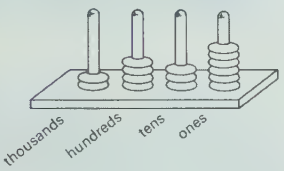
Write the standard form for each.

7. 8000 + 400 + 60 + 3 8463
8. 1000 + 700 + 30 + 8 1738
9. 9000 + 400 + 6 9406
10. 5000 + 30 + 2 5032
11. 7000 + 200 + 1 7201
12. 2000 + 600 + 80 2680
13. 6000 + 7 6007
14. 1000 + 80 1080

Write the standard and expanded forms for each.

15. four thousand three hundred sixteen 4316, 4000 + 300 + 10 + 6
16. nine thousand six hundred thirty 9630, 9000 + 600 + 30
17. seven thousand two hundred eleven 7211, 7000 + 200 + 10 + 1
18. six thousand five hundred 6500, 6000 + 500
19. five thousand one hundred two 5102, 5000 + 100 + 2
20. three thousand seventy-four 3074, 3000 + 70 + 4
21. two thousand eight 2008, 2000 + 8
22. eight thousand ten 8010, 8000 + 10

The rings on the pegs of this **abacus** show 2436.



Use an abacus or draw an abacus to show

1. 3825
2. 2029

On the abacus shown above, no peg can hold more than nine rings. When there are ten rings for one peg, trade them for one ring to be placed on the next peg to the left.

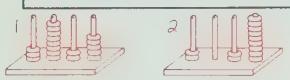
Show each of these on an abacus. If there are too many for one peg, trade 10 of them for an extra ring to place on the peg to the left.

	thousands	hundreds	tens	ones
3.	2	3	5	12
4.	2	11	3	15
5.	1	4	17	13
6.		3	9	10
7.	2	16	18	14
8.		9	12	11

How many different numbers can you show using only 4 (1, 10, 100, 1000)

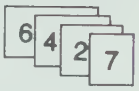
9. one ring on the abacus above?
10. two rings on the abacus above? 10 (2, 11, 20, 101, 110, 200, 1001, 1010, 1100, 2000)

try this



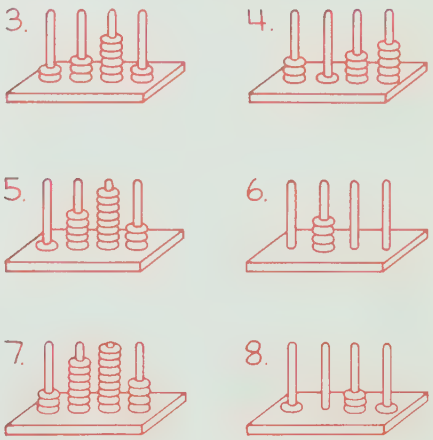
RELATED ACTIVITIES

• The numeral cards prepared for showing expanded numerals in *Before Using the Pages* may be used for a game involving two teams of students. The leader (teacher or appointed student) selects cards to show the expanded form for a number. The first member of each team writes the standard numeral on the board. A point is awarded to the team if the player's answer is correct. The cards may be overlapped to display the standard numeral.



Members of a team take turns writing the standard numerals. The winning team is the first team to reach a certain number of points, for example, 10 or 12.

try this



orking Together: Ex. 1-4 establish whether students understand the significance of the position of a digit in a numeral. The remaining examples involve writing the expanded form for a given standard numeral (Ex. 5-8) and the reverse procedure (Ex. 9-11). For Ex. 5-11, it will likely be necessary to pay particular attention to the digit 0 because the expanded form for a number shows the total value of each digit in the numeral, except for 0. This corresponds to drawing no card in the activity in *Before Using the Pages*.

xercises: Remind the students to show the plus signs in the expanded form. Note that both the standard form and the expanded form are required for Ex. 15-22.

y This: If the students have not been introduced to a simple abacus before now, this is an appropriate time to use one. It is a valuable device for representing numbers and reinforcing the base-ten concept of our numeration system. A simple abacus may be prepared as described on page T344. If students are working in small groups, the members of a group should sit on the same side of the abacus to preserve the same left-to-right order of the places. It might be advisable to label the places until students are familiar with the abacus. Emphasize that each peg can hold not more than 9 rings. If necessary, demonstrate how, in Ex. 3 for example, since 12 rings are too many for the ones' peg, 10 rings from the ones' peg are traded for an extra ring to place on the tens' peg (the peg to the immediate left of the ones' peg). This activity helps to prepare students for the concept of regrouping in addition (Unit 2).

Assessment

Write the expanded form for each.

1. 1264 1000 + 200 + 60 + 4
2. 7550 7000 + 500 + 50

Write the standard form for each.

3. 3000 + 200 + 70 + 1 3271
4. 4000 + 90 4090

Write the standard and expanded forms for each.

5. eight thousand two hundred eleven 8211, 8000 + 200 + 10 + 1
6. two thousand thirty-five 2035, 2000 + 30 + 5

Pages 10-11

OBJECTIVE

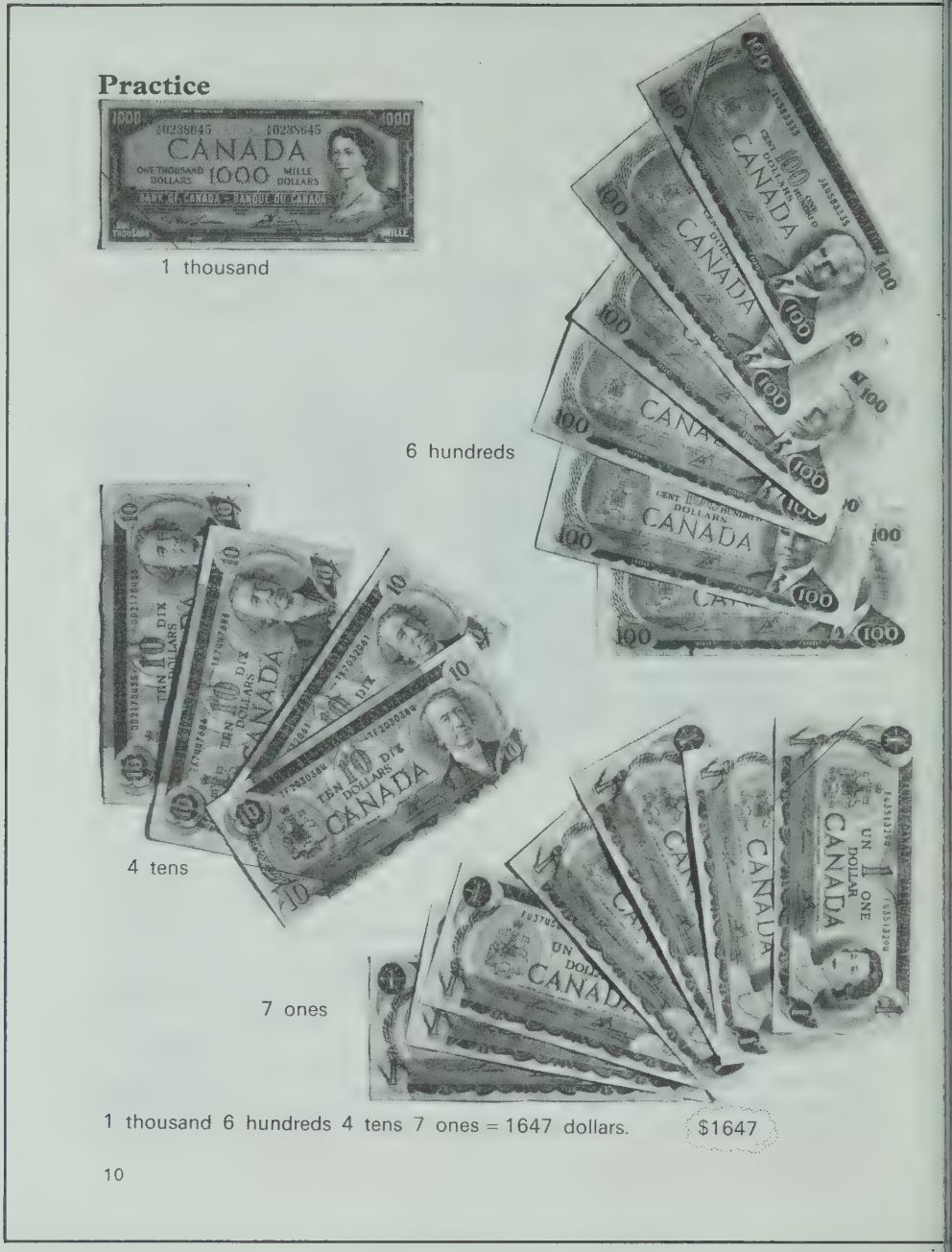
Demonstrate competence in writing the standard and expanded forms for numbers to 9999 and in interpreting place value in numerals to 9999

Materials

play money or cutouts of the bills from page T 352

Vocabulary

dollars, amount



LESSON ACTIVITY

Using the Pages

- The concepts of place value and standard and expanded forms can be applied in our system of money for bills in the denominations of one, ten, one hundred, and one thousand dollars. Have students identify the kinds of bills illustrated on page 10 and count how many there are of each kind of bill. Read the statement at the bottom of the page, drawing particular attention to the word *dollars* and the symbol $. Ask the students questions such as,
"How much money would be shown if there were no one-dollar bills?" "no hundred-dollar bills?"

  Have students write the numerals on the board. If necessary, use play money to represent these and other amounts, to ensure that they can name amounts shown and show amounts named.

  When the students have completed the exercises, ask them to read aloud the amounts shown in Ex. 1-8 and the numerals shown in Ex. 9-16.

Copy and complete the chart.

					Amount
1.	2	6	2	7	$2627
2.	? 4	? 1	? 3	0	$4130
3.	3	0	3	5	$3035?
4.	0	? 4	? 2	? 1	$421
5.	1	2	0	0	$1200 ?
6.	? 9	? 4	0	? 5	$9405
7.	5	3	2	6	$5326 ?
8.	6	0	1	0	$6010 ?

What does each 5 mean?

9. 5418 (5 thousands) **10.** 7952 (5 tens)

11. 1005 (5 ones) **12.** 3510 (5 hundreds)

What does each 0 mean?

13. 2016 (0 hundreds) **14.** 1307 (0 tens)

15. 4000 (0 hundreds, 0 tens, 0 ones) **16.** 1290 (0 ones)

Write the standard form for each.

17. 2 thousands 0 hundreds 4 tens 7 ones 2047

18. 6 thousands 2 hundreds 4 tens 5 ones 6245

19. 9 thousands 4 hundreds 6 ones 9406

20. 7000 + 600 + 20 + 4 7624

21. 4 hundreds 7 tens 6 ones 476

22. 500 + 60 + 2 562

23. nine thousand seven hundred 9700

24. 8000 + 70 + 6 8076

25. two thousand four hundred two 2402

26. 9000 + 800 + 50 + 6 9856

27. five thousand sixty-seven 5067

28. 3 thousands 8 ones 3008

Write the expanded form for each.

29. 8 thousands 3 hundreds 8 tens 2 ones 8000 + 300 + 80 + 2

30. 1037 (1000 + 30 + 7) **31.** 5726 (5000 + 700 + 20 + 6) **32.** 2403 (2000 + 400 + 3) **33.** 7830 (7000 + 800 + 30)

34. nine thousand six hundred fifty-five 9000 + 600 + 50 + 5

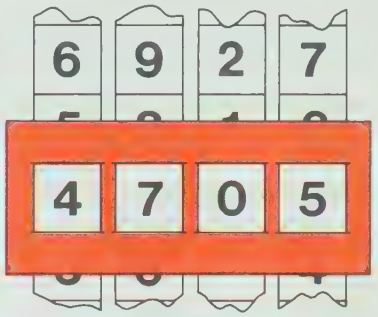
35. four thousand twelve 4000 + 10 + 2 **36.** nine hundred eight 900 + 8

37. 3740 (3000 + 700 + 40) **38.** 6500 (6000 + 500) **39.** 8020 (8000 + 20) **40.** 2002 (2000 + 2)

11

RELATED ACTIVITIES

• Each student may make a simple digital device for four-digit numerals using four strips of paper, each showing eleven squares (use copies of page T 367), and a card with four "windows". The numerals 0 to 9 are written on the squares of each strip and one square is left blank (to allow for showing numerals with fewer than four digits). The two ends of each strip may be joined to form a loop. Students may use the device to display the standard form for a number for which the expanded form is given.



• A play store in one area of the classroom can display pictures of appliances, cars, and so on, cut from magazines, catalogs, and newspapers, with their prices shown (up to four-digit whole numbers). Some students may wish to construct play appliances using boxes and simple materials and place these in the play store. Students can take turns buying and selling items, paying for them using play money or cutouts of the bills from page T 352.

Pages 12-13

LESSON OUTCOME

Compare and order numbers to 9999

Vocabulary

collector, sculpture, is greater than (>), is less than (<), least, greatest

Prerequisite Skills

Read and write standard numerals for numbers to 9999; interpret place value for four-digit numerals

Checking Prerequisite Skills

Write the standard numeral.

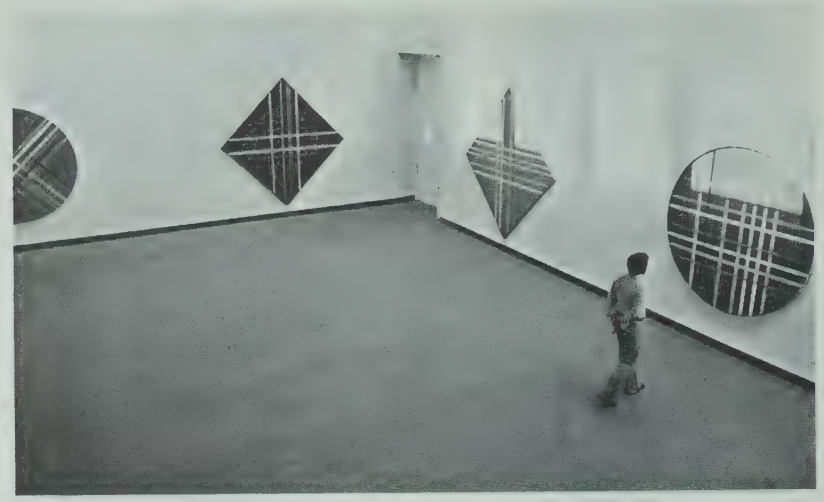
1. 4 thousands
   9 hundreds
   2 tens
   5 ones 4925
2. seven thousand sixty 7060

What does each digit mean in these numerals?

3. 1089
   1 thousand
   0 hundreds
   8 tens
   9 ones

4. 5302
   5 thousands
   3 hundreds
   0 tens
   2 ones

Comparing and Ordering Numbers



An art collector paid $2475 for a piece of sculpture and $2875 for an oil painting. For which did the collector pay more?

Look at the digits from left to right.

$2475
$2875

The digits are the same in the thousands place.

$2475
$2875

The digits are different in the hundreds place.

8 is greater than 4, so $2875 is greater than $2475.

8 > 4, so 2875 > 2475

The collector paid more for the oil painting.

Sculpture	$2475
Oil Painting	$2875
Watercolor	$1720
Drawing	$1729

The prices on the list in order, from greatest to least, are

$2875, $2475, $1729, $1720

12

LESSON ACTIVITY

Before Using the Pages

- Draw place holders on the board for two four-digit numerals.

Tell the students that you are going to show one digit at a time for each numeral. Ask them to indicate when they are certain which of the two numbers is the greater one. Then proceed to complete the two numerals in stages similar to the following.

___ ___ ___ 6	___ ___ ___ 3
___ 4 ___ 6	___ 4 ___ 3
2 4 ___ 6	5 4 ___ 3
2 4 9 6	5 4 1 3

For each stage, have students suggest reasons for knowing or not knowing which number is greater. If most students recognize at the third stage which is greater, discuss that it will make no difference to their decision what digits are written in the tens' places.

Using the Pages

- The example illustrates that to determine which of tw numbers is the greater one, the digits of the two numera are inspected from left to right.

  Begin with a brief discussion of the photograph. Som students may have visited an art gallery in their own city a nearby city. Discuss the fact that paintings and sculpture are purchased for collection and display. Have a stude read the sentences beneath the photograph.

  Lead the students through the explanation of arriving the greater number. Emphasize that the order of inspectin the digits is from left to right because this order is the mo efficient. Discuss that if the thousands' digits are differen it would be known immediately which number is greate Ask the students what they would need to do if th thousands' digits and the hundreds' digits were the same

  Draw the students' attention to the symbol > for "greater than". If possible, have a student show the symb < for "is less than" on the board. Have another stude write numerals with a symbol in a number sentence, f

Working Together

Where are the digits first different, in the thousands, hundreds, tens, or ones place?

1. 1208 / 1091 — hundreds place
2. 5076 / 5078 — ones place
3. 3989 / 4120 — thousands place
4. 2652 / 2649 — tens place

Which is greater,

5. 6 or 7? 7
6. 3574 or 3564? 3574
7. 4286 or 4287? 4287
8. 1701 or 1698? 1701

List the numbers from greatest to least.

9. 4567 4527 4167 4563
   4567, 4563, 4527, 4167
10. 4785 6780 4780 4980
    6780, 4980, 4785, 4780

Exercises

Use > or < to make true statements.

Examples: 4375 > 4075 means 4375 **is greater than** 4075.
4075 < 4375 means 4075 **is less than** 4375.

1. 2536 ◯ 2653 <
2. 1984 ◯ 1899 >
3. 4935 ◯ 4952 <
4. 8118 ◯ 8181 <
5. 2050 ◯ 2005 >
6. 6572 ◯ 7652 <

List from greatest to least.

7. 481, 976, 897, 148
   976, 897, 481, 148
8. 5310, 6922, 4000, 3939
   6922, 5310, 4000, 3939
9. 2493, 2397, 2923, 2402
   2923, 2493, 2402, 2397
10. 4443, 4344, 3444, 4444
    4444, 4443, 4344, 3444

List from least to greatest.

11. 959, 1095, 99, 2000
    99, 959, 1095, 2000
12. 3275, 3288, 3263, 3236
    3236, 3263, 3275, 3288
13. 9229, 2992, 2099, 9022
    2099, 2992, 9022, 9229
14. 7886, 7869, 7866, 7966
    7866, 7869, 7886, 7966

In a TV game show, you draw these four cards

○	○	○	○
7	0	8	9

to hang on the hooks.

*15. What is the most you could win? $9870

*16. How little could you lose? $789 ($0789)

13

RELATED ACTIVITIES

- You may wish to prepare a game board like the one shown at the bottom of page 13, using a thin sheet of plywood, five hooks, and a spinner. Prepare one card for each of the numbers from 0 to 9 and place them in a bag. Each of four players, in turn, spins the spinner, draws four cards, and hangs the cards on the hooks. The number is recorded on paper before the next player takes a turn. After each player has had one turn, the four numbers are ordered from least to greatest. The player whose number is least and the player whose number is greatest score two points each. Each of the other players scores one point. After an agreed number of rounds, the player with the most points is the winner.
- Some students would benefit from reading aloud their answers for Ex. 1-14.

example, 4 < 8. Have students suggest ways for remembering the symbols. They may suggest that each symbol always points to the lesser number.

Have students read aloud the prices on the list at the bottom of page 12. To inspect the numerals, have them use their index fingers to cover digits and work to the right, exposing one place at a time. Their results may be compared with the answer shown.

Working Together: Ex. 1-4 emphasize the left-to-right order of inspecting the digits. In Ex. 5-8 the digits 6 and 7 are used repeatedly in corresponding places as the first pair of differing digits. A similar pattern should be retained when developing additional exercises as needed. In Ex. 9 the least number probably can be determined most easily. In Ex. 10 the greatest number will likely be determined first. Each of these, however, is arrived at through a left-to-right order of inspecting the digits.

Exercises: The students are provided with examples of statements using < and > for reference as needed. Point out the different order of listing numbers for Ex. 7-10 and Ex. 11-14. Ex. 15 and 16 will provide a challenge for some students. To win an amount of money (Ex. 15), the greatest number would be desirable (9870). To lose an amount of money (Ex. 16), the least number would be desirable (0789).

Assessment

Use < or > to make true statements.

1. 3114 ◯ 3146 <
2. 4790 ◯ 4709 >

List from least to greatest.

3. 5128, 5709, 5164, 5123
   5123, 5128, 5164, 5709

List from greatest to least.

4. 6485, 6188, 6815, 6427
   6815, 6485, 6427, 6188

Pages 14-15

LESSON OUTCOME

Round numbers to the nearest ten, hundred, or thousand

Vocabulary

rounding, rounded to, nearest thousand, nearest hundred, nearest ten, kilometre, km

Prerequisite Skills

Complete patterns that increase by thousands, hundreds, and tens; interpret place value for four-digit numerals

Checking Prerequisite Skills

Complete the patterns.

1.		2.		3.	
	1610		1200		4000
	1620		1300		5000
	1630		1400		6000
	1640		1500		7000
	1650		1600		8000
	1660		1700		9000
	1670		1800		
	1680		1900		

What does the marked digit mean in each numeral?

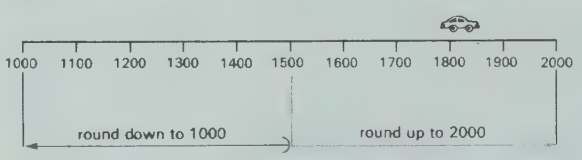
4. 2317 2 thousands
5. 6085 5 ones
6. 1340 4 tens
7. 4962 9 hundreds

Rounding

The car has traveled 1826 km (kilometres).

Which statement is closer to being correct?

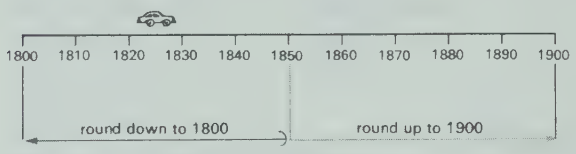
The car has traveled about 1000 km.
The car has traveled about 2000 km.



"The car has traveled about 2000 km" is closer to being correct.

1826 rounded to the nearest thousand is 2000.

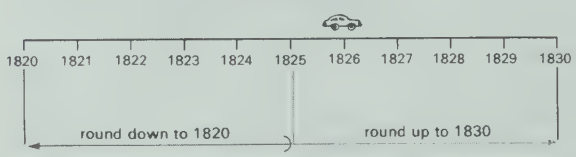
The car has traveled about 1800 km.
The car has traveled about 1900 km.



"The car has traveled about 1800 km" is closer to being correct.

1826 rounded to the nearest hundred is 1800.

The car has traveled about 1820 km.
The car has traveled about 1830 km.



"The car has traveled about 1830 km" is closer to being correct.

1826 rounded to the nearest ten is 1830.

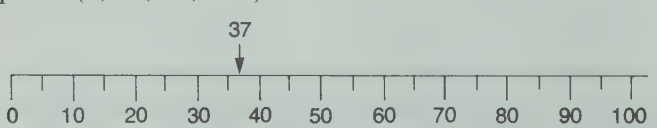
14

LESSON ACTIVITY

Before Using the Pages

- In advance of the lesson, prepare several unmarked number lines on the board. Space the points at intervals of at least 10 cm. Provide for eleven points on each line. Prepare students for the concept of rounding numbers through activities similar to the following.

  Have the students start at 0 and count by tens to 100. Write the numerals on the first number line. Show the points for the multiples of 5, but do not write the numerals. Have students identify the numbers indicated by these points (5, 15, 25, . . .).



Ask the students, "Between which two tens (multiples of ten) is 37 found?" Point to the approximate position of 37 on the number line and ask, "For 37, is 30 the nearest ten or is 40 the nearest ten?" "How can you tell?" Write the numerals 37 and 40 in a chart as shown and say, "For 37 the nearest ten is 40." Ask similar questions about other numbers such as 34, 36, 82, 89, and 97.

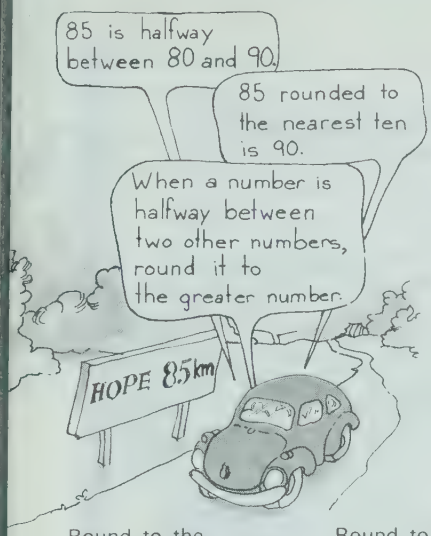
number	nearest ten
37	40

Use a similar procedure to prepare students for the concept of rounding to the nearest hundred and to the nearest thousand. Mark some number lines to show multiples of 100 and others to show multiples of 1000.

Using the Pages

- The worked example introduces the concept of rounding numbers in relation to the approximate distance traveled by a car. Briefly discuss situations in which this might occur.

  For the students, the title *Rounding* can be thought of as relating a number to its nearest ten (hundred, thousand). The illustrations will likely remind the students of the concept of the number line. Discuss each example in turn.


85 is halfway between 80 and 90.
85 rounded to the nearest ten is 90.
When a number is halfway between two other numbers, round it to the greater number.
HOPE 85km

Working Together

Which digit is best for the ?

1. 22 is between 20 and 0. 3
2. 645 is between 6 0 and 650. 4
3. 452 is between 400 and 00. 5
4. 1350 is between 1 00 and 1400. 3
5. 3384 is between 3000 and 000. 4
6. 8707 is between 000 and 9000. 8

Answer these questions.

7. Is 22 closer to 20 or to 30? 20
8. Is 452 closer to 400 or to 500? 500
9. Is 3384 closer to 3000 or to 4000? 3000
10. Is $1350 closer to $1300 or to $1400? halfway between

Round to the nearest ten.

11. 22 20 **12.** 198 200

Round to the nearest hundred.

13. 452 500 **14.** 1011 1000

Round to the nearest thousand.

15. 3384 3000 **16.** 4500 5000

Exercises

Round to the nearest ten.

1. 64 60 **2.** 75 80 **3.** 41 40 **4.** 117 120 **5.** 255 260 **6.** 439 440

Round to the nearest hundred.

7. 813 800 **8.** 1684 1700 **9.** 901 900 **10.** 250 300 **11.** 3449 3400 **12.** 2550 2600

Round to the nearest thousand.

13. 9400 9000 **14.** 4300 4000 **15.** 1629 2000 **16.** 5500 6000 **17.** 7236 7000 **18.** 2910 3000

Copy and round each of these

19.

to the nearest	$2915	$7350	$1479	$3547	$2495	$4048
ten	$2920	$7350	$1480	$3550	$2500	$4050
hundred	$2900	$7400	$1500	$3500	$2500	$4000
thousand	$3000	$7000	$1000	$4000	$2000	$4000

15

RELATED ACTIVITIES

- Students can apply the concept of rounding numbers to situations related to the school environment. Some examples are given.

1. The number of students in our class is _____. To the nearest ten, there are _____ students in our class.
2. There are _____ students in our school. To the nearest hundred, there are _____ students in our school.
3. There are _____ pages in the dictionary. To the nearest thousand, there are _____ pages in the dictionary.

- Interesting facts can be taken from such books as a *World Atlas* and the *Guinness Book of Records*. The numbers given in these facts can be rounded by the students to the nearest ten, hundred, or thousand. At this time the numbers selected should be less than 10 000.

paying close attention to the statements that appear in "thought clouds". Give several students an opportunity to read aloud the statements so that they will become familiar with the terminology. Discuss the significance of the red and the blue arrows in each illustration. Note that all numbers in the red portions are "rounded down" because they are to the left of the halfway mark and thus are closer to the lower limit than to the upper limit.

The illustration at the top of page 15 describes an important situation. That is, some numbers are halfway between two tens (hundreds, thousands) and thus are just as close to one ten (hundred, thousand) as to the other. Explain that in such cases it is agreed that the given number is "rounded up" to the greater ten (hundred, thousand). Thus, 85 km rounded to the nearest ten is 90 km.

Working Together: Ex. 1-6 involve the skill of identifying the upper and lower limits for rounding a number to the nearest ten (Ex. 1 and 2), nearest hundred (Ex. 3 and 4), and nearest thousand (Ex. 5 and 6). Ex. 7-10 name the upper and lower limits for rounding numbers and examine the skill of naming which limit is closer to the given number. Note that for Ex. 10 neither amount is closer to $1350 but, by agreement, $1350 would be rounded to $1400. Use other similar examples as needed and relate each to a number line, if necessary. For Ex. 11-16, students must use both skills described above to round each number.

Exercises: Some students may need to use number lines or simply a reminder to think of counting by tens, by hundreds, or by thousands. It will be interesting to note those students who recognize that $7350 in Ex. 19 is expressed to the nearest ten as is. In the same exercise, rounding $2495 to the nearest ten may present difficulty. If so, it is likely best explained with the aid of a number line.

Assessment

Round to the nearest ten.

1. 83 80 **2.** 605 610

Round to the nearest hundred.

3. 481 500 **4.** 6217 6200

Round to the nearest thousand.

5. 4782 5000 **6.** 6050 6000

Pages 16-17

LESSON OUTCOME

Read and write numerals and words for ordinal numbers to *nine hundred ninety-ninth*; use these numbers to identify positions

Materials

old magazines, newspapers, books; a copy of page T 367 for each student

Vocabulary

names of the ordinal numbers to *nine hundred ninety-ninth*, tally, customer, ordinal number

Prerequisite Skills

Understand ordinal numbers to *thirtieth*; write numerals for numbers to 999

Checking Prerequisite Skills

Tell which letter of the alphabet is

1. fourteenth N
2. 2nd B
3. eighth H
4. 11th K
5. twenty-first U
6. 3rd C

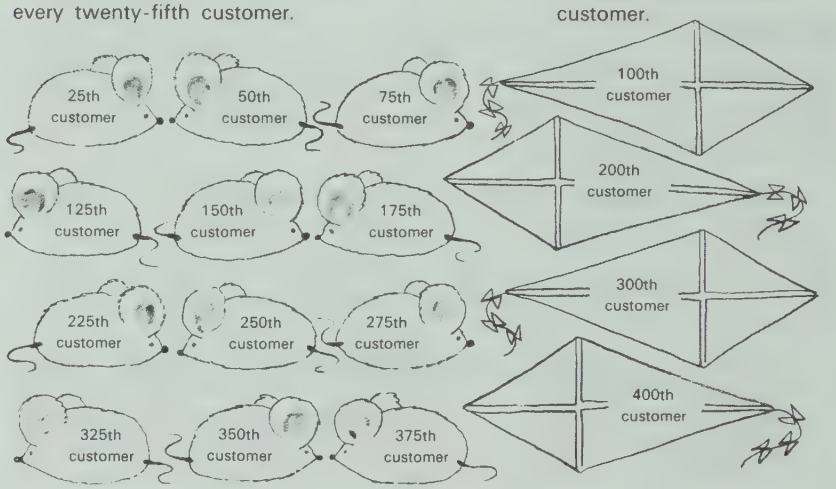
Write the numeral.

7. three hundred forty 340
8. six hundred three 603
9. five hundred twenty-one 521

Ordinal Numbers

A toy mouse was the prize for every twenty-fifth customer.

A kite was the prize for every one-hundredth customer.



16

LESSON ACTIVITY

Using the Pages

- Begin with a brief discussion of new store openings and the features that are often used to attract customers, for example, giving prizes to various customers.

  Have a student read the statements on the banner at the top of page 16. Discuss that not every customer receives a prize. Say, for example,

  "Will the third customer win a prize?"

  "Name other customers who would not win a prize at the store opening."

  For each ordinal number named, have some students write the word and the numeral on the board. Note that the word "and" is not used in reading the numerals; for example, 271st is read "two hundred seventy-first". Explain that an ordinal number names a position and answers the question, "Which one?" (A cardinal number answers the question, "How many?")

  For the numerals, explain the use of abbreviations such as *st*, *nd*, *rd*, and *th* as in 1st, 2nd, 3rd, and 4th. For the words, identify changes in spelling, such as the *y* in *twenty* changing to *i* before the *eth* is added to form *twentieth*.

  Ask which customer would be the first to win a toy mouse and which would be the first to win a kite. Have students name customers, other than those identified on page 16, who would win prizes. Have them show the numerals and the words on the board. Also, ask questions such as,

  "Which customer entered the store just before the three hundred fiftieth customer?"

  "Which customer entered the store just after the four hundredth customer?"

Working Together: These exercises may be completed orally to establish the correct numbers for the concept of order. Then the students may write the numerals and the words. These may be shown on the board and discussed. Use other examples to 999th as required.

1 409th, 410th, 411th, 412th, 413th, 414th, 415th, 416th, 417th, 418th, 419th, 420th
2 299th, 300th, 301st, 302nd, 303rd, 304th, 305th, 306th, 307th, 308th, 309th, 310th

Working Together

5. one hundred thirty-fifth
6. four hundred third
7. five hundred twenty-second
8. three hundred ninety-first

Who comes after

1. the ninety-ninth customer? 100th
2. the 200th customer? 201st
3. the 323rd customer? 324th
4. the 611th customer? 612th

Who comes before

5. the 500th customer? 499th
6. the two hundred third customer? 202nd
7. the 404th customer? 403rd
8. the 320th customer? 319th

Exercises

List these in order.

1. 415th, 411th, 410th, 417th, 419th, 420th, 412th, 414th, 416th, 418th, 413th, 409th
2. 299th, 308th, 304th, 302nd 307th, 301st, 309th, 306th 303rd, 305th, 300th, 310th

Write using numerals.

3. five hundredth 500th
4. two hundred twentieth 220th

Write the words.

5. 135th
6. 403rd
7. 522nd
8. 391st

At the Grand Opening, what did

9. the 250th customer win?
10. the 700th customer win?
11. the 525th customer win?

Who won

12. the 3rd prize to be awarded?
13. the 4th prize to be awarded?
14. the 10th prize to be awarded?
*15. the 21st prize to be awarded?
*16. the 32nd prize to be awarded?

9. a toy mouse 10. a kite 11. a toy mouse
12. 75th customer 13. 100th customer
14. 250th customer 15. 525th customer
16. 800th customer

Guess:

Which of these letters
A, E, N, O, T
is used most often? E

Test your guess:

Choose any story in a newspaper or any page in a book. In a chart like this

A	E	N	O	T
III	~~III~~	IIII	II	IIII

tally the number of times each letter appears in the story or on the page.

Count your tallies. Compare the results with your guess.

Make a graph to show your results.

PROBLEM SOLVING

17

RELATED ACTIVITIES

- In connection with the date, which is often written on the board daily, have students determine the ordinal name. For example, September 21 is the two hundred sixty-fourth (264th) day, and September 22 is the 265th day.

Exercises: The order implied for Ex. 1 and 2 is least to greatest. Ex. 15 and 16 will provide a challenge for some students. Ask them to explain the procedure they used to find the answers.

Problem Solving: This problem provides experience in collecting data and graphing information. Note that the letter E is used most often. It occurs about 13 times in every 100 letters. The letter T occurs about 9 times, A and O occur about 8 times each, and N occurs about 7 times.

Provide each student with an article cut from a magazine or a newspaper and a copy of page T367 for graphing the results. Help the students prepare headings and a scale for the graph. A bar graph would likely be the most suitable. When the graphs are completed, display them for several days and provide an opportunity for comparing and discussing the results obtained.

Assessment

List in order.

1. 525th, 524th, 521st, 523rd, 522nd, 520th

520th
521st
522nd
523rd
524th
525th

Write the numerals.

2. four hundred fiftieth 450th
3. nine hundred eighty-second 982nd

Write the words.

4. 200th two hundredth
5. 782nd seven hundred eighty-second

Pages 18-19

LESSON OUTCOME

Read and write standard numerals and words for numbers to 999 999; write the expanded form for numbers to 999 999; interpret place value for numbers to 999 999

Materials

two place-value pocket charts as illustrated in *Before Using the Pages*

Vocabulary

names for numbers to 999 999, ten thousands, hundred thousands, place-value chart

Prerequisite Skills

Read and write standard numerals and words for numbers to 9999; write the expanded form for numbers to 9999; interpret place value in numerals to 9999

Checking Prerequisite Skills

Write the word name.

1. 2605 two thousand six hundred five
2. 4007 four thousand seven

What does each digit mean?

3. 2605 2 thousands 6 hundreds 0 tens 5 ones
4. 4007 4 thousands 0 hundreds 0 tens 7 ones

Write the expanded form.

5. 9423 9000 + 400 + 20 + 3
6. 3081 3000 + 80 + 1

Write the standard numeral.

7. 7000 + 600 + 9 7609
8. nine thousand eighty-one 9081

Numbers to 999 999

When the moon is closest to the earth, the distance between them is 354 341 km.

In a six-digit numeral, the first three digits from the left show the number of thousands.

hundreds	tens	ones	hundreds	tens	ones
thousands					
3	5	4	3	4	1

The closest the moon comes to the earth is *354 thousand 341* km.

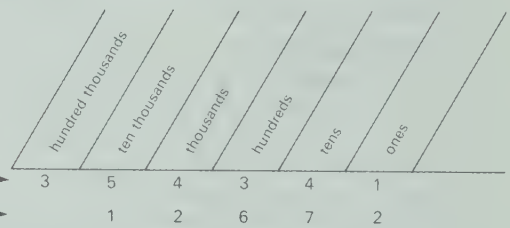
The distance across the earth is 12 672 km.

In a five-digit numeral, the first two digits from the left show the number of thousands.

hundreds	tens	ones	hundreds	tens	ones
thousands					
1	2		6	7	2

12 thousand 672 km

This chart shows the value of each place in a six-digit numeral.



In expanded form 354 341 = 300 000 + 50 000 + 4 000 + 300 + 40 + 1

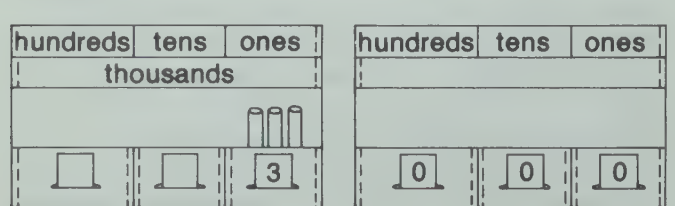
18

LESSON ACTIVITY

Before Using the Pages

- Use the sticks and numeral cards with a place-value pocket chart (see page T 344) to review how to represent each of the numbers 1, 10, and 100, in turn. Review that 10 ones equal 1 ten and 10 tens equal 1 hundred. Ask what 10 hundreds are equal to.

  Display a second place-value pocket chart to the left of the first chart, labeled as illustrated, and leave a space between the two charts. Represent 1000 and its multiples (to 9000).



Develop that 10 *one thousands* equal 1 *ten thousand* and 10 *ten thousands* equal 1 *hundred thousand*. Draw a comparison between corresponding headings of the two charts; for example, the ones' place corresponds to the one-thousands' place and the tens' place corresponds to the ten-thousands' place. Use the charts to represent 10 000 and its multiples (to 90 000) and 100 000 and its multiples (to 900 000).

Using the Pages

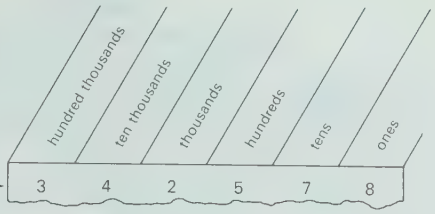
- The example provides two instances in which numbers greater than 1000 are involved. The place-value charts illustrated help students to realize that six-place numerals may be read in much the same way as two groups of three-place numerals are read. The six-place numerals are seen as consisting of two groups, each of which shows hundreds, tens, and ones. The first three digits from the left, however, name the number of *hundred thousands*, *ten thousands*, and *one thousands*. To help students read the six-place numeral 354 341, it is shown in the concluding statement as 354

Working Together

Leave a space after the thousands.

Copy and complete.

1.	475 thousand 354	475 354
2.	62 thousand ?	?
3.	225 ? 675	225 675
4.	? thousand ?	504 370



Use the place-value chart to help you answer these questions.

Example: The 4 in 342 578 means 40 000.

5. What does the 6 mean in 645 207?
6. What does each digit mean in 802 914?

6. 8 hundred thousands
0 ten thousands
2 thousands
9 hundreds
1 ten
4 ones

Write the expanded form.

7. 725 348
8. 106 309

7. 700 000 + 20 000 + 5 000 + 300 + 40 + 8
8. 100 000 + 6 000 + 300 + 9

Write the standard form.

9. 400 000 + 30 000 + 200 + 1

9. 430 201
11 one hundred twenty-three thousand four hundred fifty-six
12 seven hundred thirty-two thousand fifty-six
13 three hundred ninety thousand two hundred
14 two hundred two thousand twenty

Exercises

Write the standard form.

1. 92 thousand 652
2. 461 thousand 254
3. fifty-five thousand nine hundred
4. eight hundred twenty thousand
5. two hundred six thousand five
6. one hundred thousand twelve
7. 600 000 + 70 000 + 30 + 6
8. 50 000 + 300 + 20 + 7
9. 300 000 + 9 000 + 800 + 40
10. 100 000 + 1 000 + 100 + 1

1. 92 652
2. 461 254
3. 55 900
4. 820 000
5. 206 005
6. 100 012
7. 670 036
8. 50 327
9. 309 840
10. 101 101

Write the words.

11. 123 456
12. 732 056
13. 390 200
14. 202 020

Write the expanded form.

15. 625 378
16. 902 517
17. 56 001
18. 303 030

What does the 5 mean in each numeral?

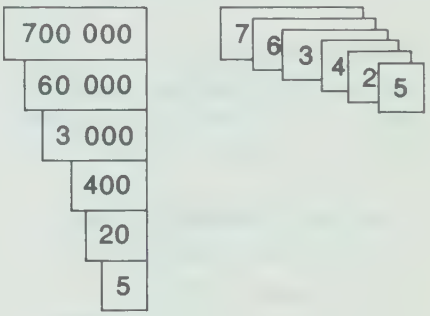
19. 123 456
20. 561 234
21. 612 345
22. 456 123
23. 234 561
24. 345 612

15. 600 000 + 20 000 + 5 000 + 300 + 70 + 8
16. 900 000 + 2 000 + 500 + 10 + 7
17. 50 000 + 6 000 + 1
18. 300 000 + 3 000 + 30

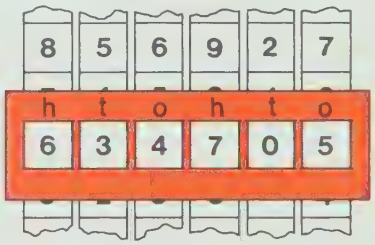
19. 5 tens
20. 5 hundred thousands
21. 5 ones
22. 5 ten thousands
23. 5 hundreds
24. 5 thousands

RELATED ACTIVITIES

• Prepare a set of cards for multiples of 1 (to 9), of 10 (to 90), of 100 (to 900), of 1000 (to 9000), of 10 000 (to 90 000), and of 100 000 (to 900 000). The lengths of the cards should be such that the cards may overlap to show the standard numeral for a number. Students may work alone or in small groups showing the two forms for any given number (to 999 999).



• The digital device described in *Related Activities* on page T 11 may be extended to show six-place numerals. Adapted as illustrated below, it can be useful in helping students to read six-place numerals.



thousand 341 km, and this helps to show the two groups of three digits. Similarly, 12 672 km is shown as 12 *thousand* 672 km.

Have students read the numerals shown in the expanded form for 354 341 at the bottom of page 18.

It is important to draw to the students' attention the space that appears between the thousands' place and the hundreds' place, for example, 12 672. Relate this space to the space deliberately left between the two pocket charts in the activity in *Before Using the Pages*. The students themselves will likely be able to suggest that this space helps the eye to see the two groups of hundreds, tens, and ones, and facilitates reading the numeral.

Working Together: Ex. 1-4 help to develop the skill of reading and writing numerals with up to six digits. Ex. 5 and 6 involve interpreting the meaning of each digit. If necessary, use the pocket charts to help students understand these and other similar exercises. For Ex. 7 and 8, review that a place in which the digit 0 appears is not represented in the expanded form. Also, remind the students of the space that appears to the right of the thousand's place in the standard form of a numeral.

Exercises: Some students may need assistance with exercises that show 0 in the ten-thousands' place and/or the thousands' place. If necessary, refer to the place-value pocket charts and help these students in small groups.

Assessment

Write the words.

1. 642 135 — six hundred forty-two thousand one hundred thirty-five
2. 807 092 — eight hundred seven thousand ninety-two

Write the standard form.

3. one hundred twelve thousand five hundred seven — 112 507
4. 200 000 + 70 000 + 400 + 80 + 3 — 270 483

Write the expanded form.

5. 27 089 — 20 000 + 7000 + 80 + 9
6. 902 750 — 900 000 + 2000 + 700 + 50

What does each digit mean?

7. 240 831 — 2 hundred thousands, 4 ten thousands, 0 thousands, 8 hundreds, 3 tens, 1 one

Pages 20-21

LESSON OUTCOME

Compare and order numbers to 999 999

Materials

numeral cards as described in *Before Using the Pages*

Vocabulary

names of the cities shown on pages 20 and 21

Prerequisite Skills

Read and write standard numerals for numbers to 999 999; interpret place value for six-digit numerals

Checking Prerequisite Skills

Write the standard numeral.

1. one hundred twenty-three thousand four hundred eighteen 123 418
2. six hundred nine thousand seven hundred 609 700

What does each digit mean?

3. 407 125 4 hundred thousands
   0 ten thousands
   7 thousands
   1 hundred
   2 tens
   5 ones

Comparing and Ordering Numbers

Which city has more people, Saskatoon or Kitchener?

132 291 shows 132 thousands.
130 866 shows 130 thousands.

132 is greater than 130, so
132 291 is greater than 130 866.

132 > 130, so
132 291 > 130 866

Saskatoon has more people than Kitchener.

The cities are listed here in order, from those with the most people to those with the fewest people.

Saskatoon	132 291
Kitchener	130 866
St. Catharines	121 657
Longueuil	119 994
Halifax	113 036
Thunder Bay	110 288

20

LESSON ACTIVITY

Before Using the Pages

- In advance of the lesson, prepare a set of cards for six-place numerals such that there are several pairs of numerals that differ in only one place; for example,
  321 466, 340 466, 540 166, 540 199,
  320 466, 540 466, 540 196, 840 199.
  Display pairs of numeral cards, in turn, and have students say which is the greater (lesser) of the two numbers. Have them give reasons for their answers.

Using the Pages

- Have students read the names of the cities indicated on the map. Suggest reasons why the number of people in a city is important factual information.

  The worked example reviews the left-to-right order of examining the digits when comparing numbers. However, for six-digit numerals, the comparison is easier when the first three digits from the left are grouped and compared a number of thousands. Thus, for 132 291 and 130 866, th comparison involves 132 (thousands) and 130 (thousands

  Read the worked example with the students to develo the relationship 132 291 > 130 866. Have students rea the numerals listed at the bottom of page 20 for th populations of the six cities. Then, name any two of the s cities and have students suggest which has more (fewe people and give reasons for their answers. For example, f St. Catharines and Halifax,

  $$113 < 121,$$

  and thus

  $$113\,036 < 121\,657.$$

Working Together: Ex. 1 and 2 emphasize the left-to-rig order of inspecting the digits. Have students give reaso orally for their choices in Ex. 3 and 4. For Ex. 5 and 6, as how the least number can be determined quickly (it is th only numeral with fewer than six digits). Note the differe order stipulated for listing the numbers in Ex. 5 and 6.

Working Together

In which place, from left to right, are the digits first different?

1. 721 574 / 721 642 — hundreds place
2. 814 693 / 835 019 — ten thousands place

Which is greater,

3. 525 236 or 625 206? 625 206
4. 927 344 or 928 314? 928 314

List from greatest to least.

5. 243 913, 300 744, 341 903, 143 913, 43 913
   341 903, 300 744, 243 913, 143 913, 43 913

List from least to greatest.

6. 926 141, 926 211, 100 976, 92 649, 696 517
   92 649, 100 976, 696 517, 926 141, 926 211

Exercises

Which city in each pair has more people? Use > or < to compare the numbers.

Example: 82 976 < 84 994, so Saint John has fewer people than St. John's.

1.	Saint John	82 976	<	St. John's	84 994
2.	Calgary	457 828	>	Edmonton	452 095
3.	Québec	173 959	<	Windsor	192 683
4.	Chilliwack	8 472	>	Flin Flon	8 431
5.	Mississauga	246 766	>	Laval	241 297
6.	Whitehorse	13 045	<	Charlottetown	16 508
7.	Winnipeg	553 148	>	Hull	58 160
8.	Moose Jaw	31 884	<	Medicine Hat	32 263

List from greatest to least.

9. 385 544, 389 544, 33 999, 305 544, 309 544
   389 544, 385 544, 309 544, 305 544, 33 999

List from least to greatest.

10. 940 726, 944 276, 939 939, 799 000, 940 727
    799 000, 939 939, 940 726, 940 727, 944 276

Show

*11. the greatest number that can be named with six different digits. 987 654

*12. the least number that can be named with six different digits. 102 345

21

RELATED ACTIVITIES

- Students may be interested in locating on a map of Canada the cities named on page 20. Also, they may wish to select several other cities, locate them on the map, find the populations of the cities, and compare the numbers. More capable students may be able to show the populations of several cities in the form of a bar graph.

xercises: Some students may need to review which symbol shows "is less than" and which shows "is greater than". Some assistance is given by the example on page 21. Ex. 11 and 12 will help to indicate which students have a particularly good understanding of the concept of place value.

ssessment

Which is greater,

. 35 401 or 33 695? 35 401

. 427 863 or 429 102? 429 102

ist from least to greatest.

. 408 354, 40 354, 485 354, 428 453, 428 835
40 354
408 354
428 453
428 835
485 354

Pages 22-23

LESSON OUTCOME

Read and write Roman numerals for numbers to 100

Materials

a few books for which the introductory pages are numbered with Roman numerals (optional), 15 toothpicks for each student

Vocabulary

Roman numerals

Prerequisite Skills

Name numbers in terms of other numbers, sometimes using addition or subtraction

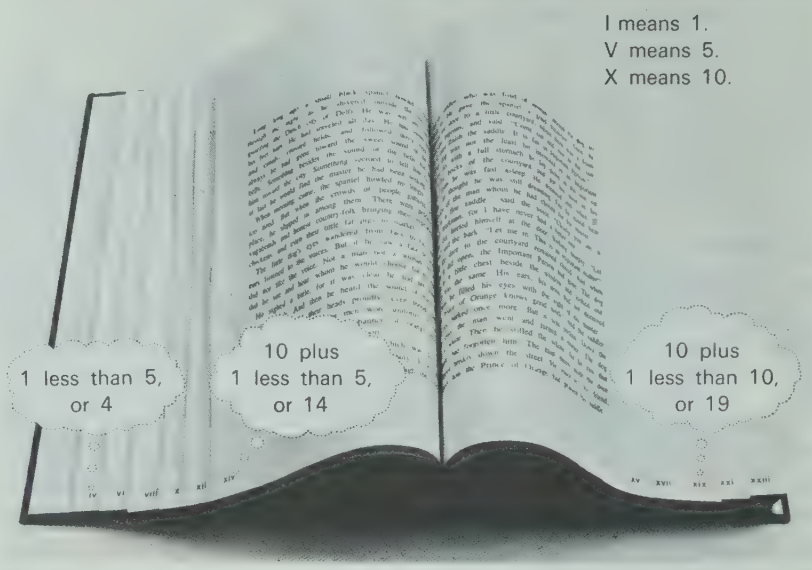
Checking Prerequisite Skills

Complete.

1. 29 = 30 − 1
2. 7 = 5 + 2
3. 20 = 2 tens
4. 14 = 10 + 4
5. 60 = 50 + 10

Roman Numerals

The pages at the front of a book may be numbered with **Roman numerals**.



Working Together

Choose one numeral from each table to make Roman numerals.

Example: 84 = LXXXIV (80 4)

1. 56 LVI
2. 94 XCIV
3. 39 XXXIX

Draw a square around the tens.

Draw a circle around the ones.

Write the standard form for each.

Example: X X I X = 29

4. XLIV
5. LXXXIX
6. XCVIII

4 XL (IV), 44

22 5 LXXX (IX), 89

6 XC (VIII), 98

Numerals for multiples of 10
10 = X
20 = XX
30 = XXX
40 = XL
50 = L
60 = LX
70 = LXX
80 = LXXX
90 = XC
100 = C

Numerals for 1 to 9
1 = I
2 = II
3 = III
4 = IV
5 = V
6 = VI
7 = VII
8 = VIII
9 = IX

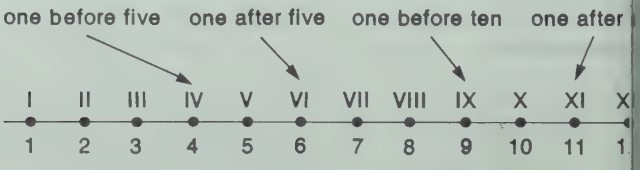
LESSON ACTIVITY

Using the Pages

- Have a student write the numeral for "three" on the board. Discuss that hundreds of years ago, people who lived under the influence of the Romans used to write numerals that are different from ours today, and that we refer to those numerals as Roman numerals.

  If there is a student who is familiar with Roman numerals, ask her/him to write the Roman numeral for "three" on the board. Have students suggest where they have seen Roman numerals. They may suggest numerals on some clock faces or the introductory pages of some books. Have some examples of such books available, if possible, for the students to examine.

  The example identifies the Roman numerals for 1, 5, and 10 and demonstrates how these may be used to write numerals for 4, 14, and 19. The procedure involves addition and/or subtraction. Discuss the examples shown and have students explain other Roman numerals in the illustration by explaining the operation involved; f example, VIII for eight shows five (V) and three more (II Contrast the significance of placing the Roman numera before the numeral V for IV and placing it after for VI. Th may be illustrated on a number line as shown.



Working Together: Draw the students' attention first to t table showing Roman numerals for 1 to 9. Discuss ea numeral in turn; for example, two is one plus one, seven five plus two, and nine is ten minus one. Then discu numerals for multiples of ten in a similar manner. The tables will be helpful to the students when working t exercises. Drawing attention to the ones and tens for E 4-6 will emphasize the inconvenience of the Roman syste and the convenience of our own system.

Exercises

Write the standard form for each.

1. X 10
2. VIII 8
3. XVI 16
4. XXXVII 37
5. XXIV 24
6. XL 40
7. XIX 19
8. LIV 54
9. XCI 91
10. LXII 62
11. LXXIII 73
12. XLVIII 48

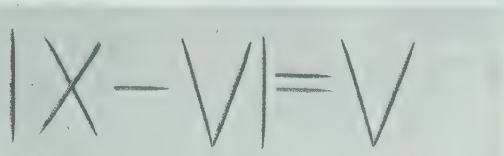
Write the Roman numerals.

13. 2 II
14. 8 VIII
15. 70 LXX
16. 26 XXVI
17. 19 XIX
18. 34 XXXIV
19. 51 LI
20. 100 C
21. 85 LXXXV
22. 96 XCVI
23. 47 XLVII
24. 63 LXIII

Complete the patterns.

25. V, X, XV, , ,
26. X, XX, XXX, , ,
27. VI, XVI, XXVI, , ,
28. IV, XIV, XXIV, , ,
29. IV, IX, XIV, , ,
30. II, IV, VI, , ,
31. XI, XXII, XXXIII, , ,
*32. LV, LXVI, LXXVII, , ,

Use toothpicks to make these number sentences. Then show how to turn each sentence into a true statement by moving one toothpick.

1. 
2.
3.
4.

1. IX − IV = V
2. V = IV + I
3. IX − VI = III
4. VIII − VI = II

Other answers are possible

try this

25 XX, XXV, XXX
26 XL, L, LX
27 XXVI, XLVI, LVI
28 XXXIV, XLIV, LIV
29 XIX, XXIV, XXIX
30 VIII, X, XII
31 XLIV, LV, LXVI
32 LXXXVIII, XCIX, CX

RELATED ACTIVITIES

• Students who enjoyed the *Try This* feature may be interested in developing similar kinds of problems for other students to try. Ensure that they write their solutions as well as their problems so that other students may check their answers. Some examples are given. II + II = VI can give each of the following true statements by moving one toothpick.

III + II = V
II + II = IV

LX = XX − X

can give

IX = XX − XI.

• A short story can be written and any numerals in the story may be shown using Roman numerals. Students may read the story aloud and/or replace the Roman numerals in the story with standard numerals.

A story similar to the following may be adapted by each student for her/his own situation.

"My name is Jason. I am IX years old. There are IV children in my family. I live at LXIX Orchard St. There are XXIX children in my class at school."

xercises: The students may use the tables on page 22, as needed, to help them with these exercises. However, they may be able to derive most numerals if they memorize the numerals I (1), V (5), X (10), L (50), and C (100) and use addition and subtraction as required to derive numerals for other numbers.

The procedure of identifying the ones and the tens (as in Ex. 4-6 of *Working Together*) may be helpful here in determining what numbers are shown in Ex. 1-12. Similarly, for Ex. 13-24, students may prefer to represent the ones first and then the tens. Besides providing experience in writing Roman numerals, Ex. 25-32 can provide an opportunity to emphasize the advantages of our system of numeration. For example, the pattern in Ex. 31 can be identified and continued to 44, 55, 66 quite easily if seen as 11, 22, 33,. . . . Contrast this with the Roman numerals that show the number pattern.

ry This: Provide each student with 15 toothpicks to represent the Roman numerals shown in these exercises. If necessary, review the meaning of the symbol =. Encourage the students to find more than one way of turning the first number sentence into a true statement. For example, IX − VI = V can be turned into any of the following true statements by moving one toothpick.

X − VI = IV
IX − V = IV
XI − VI = V
IX − IV = V

Assessment

Write the standard form.

1. XIII 13
2. XXXVI 36
3. XL 40

Write the Roman numerals.

4. 17 XVII
5. 24 XXIV
6. 62 LXII

LESSON OUTCOME

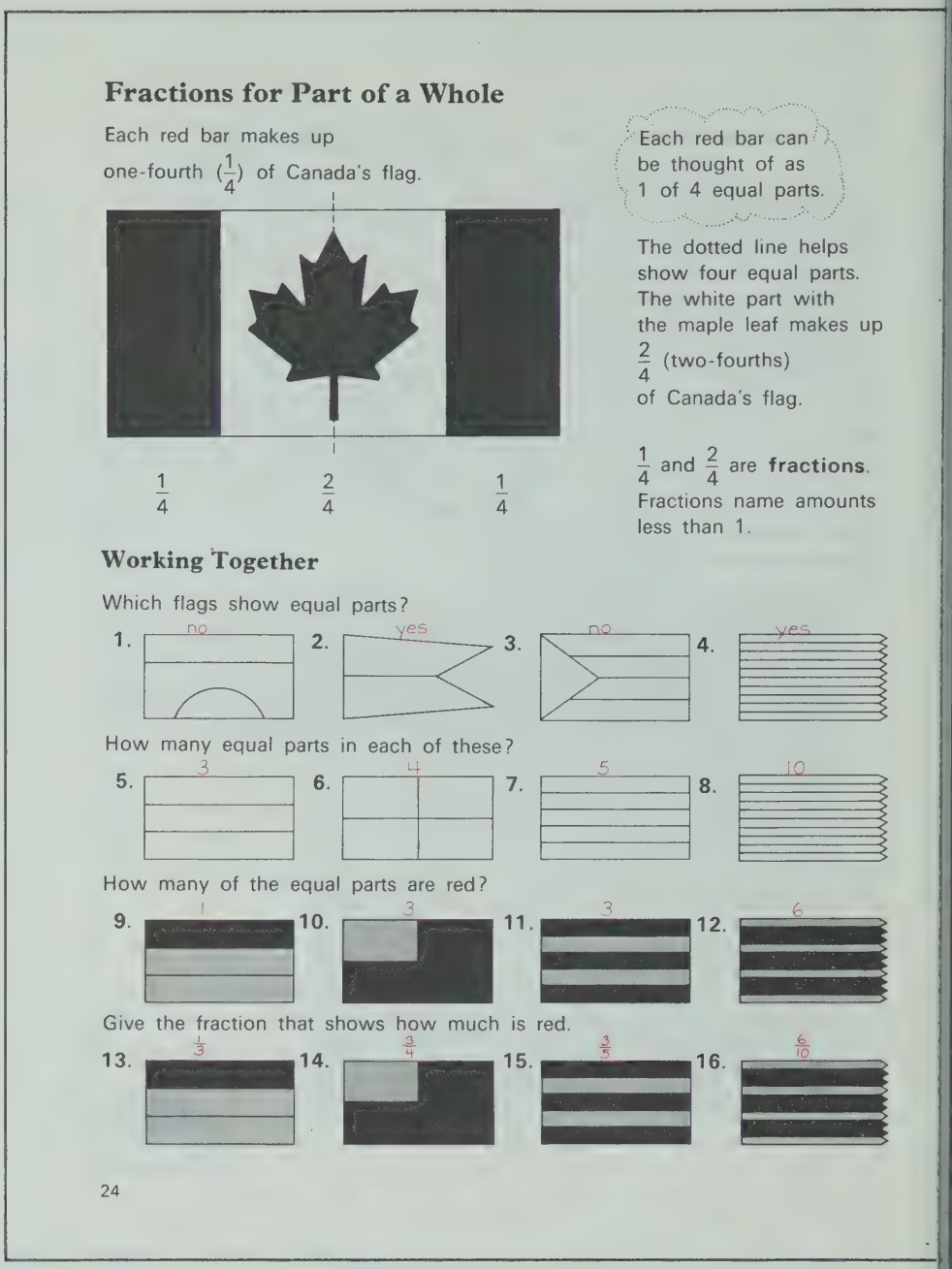
Read and write numerals for fractions less than one for part of a whole (halves, thirds, fourths, fifths, and tenths); draw diagrams to illustrate fractions less than one for part of a whole

Materials

display board; several shapes that show halves, thirds, fourths, fifths, and tenths; a few shapes that show 2, 3, 4, 5, and 10 unequal parts; six small rectangular sheets of paper for each student (optional); a straight edge and crayons for each student; pictures of the flags for the ten provinces of Canada (see page 26); pictures of the flags for different countries of the world

Vocabulary

fraction, names of fractions less than one for halves, thirds, fourths, fifths, and tenths


Fractions for Part of a Whole
Each red bar makes up one-fourth ($\frac{1}{4}$) of Canada's flag.
Each red bar can be thought of as 1 of 4 equal parts.
The dotted line helps show four equal parts. The white part with the maple leaf makes up $\frac{2}{4}$ (two-fourths) of Canada's flag.
$\frac{1}{4}$ $\frac{2}{4}$ $\frac{1}{4}$
$\frac{1}{4}$ and $\frac{2}{4}$ are fractions. Fractions name amounts less than 1.
Working Together
Which flags show equal parts?
1. no 2. yes 3. no 4. yes
How many equal parts in each of these?
5. 3 6. 4 7. 5 8. 10
How many of the equal parts are red?
9. 1 10. 3 11. 3 12. 6
Give the fraction that shows how much is red.
13. $\frac{1}{3}$ 14. $\frac{3}{4}$ 15. $\frac{3}{5}$ 16. $\frac{6}{10}$
24

LESSON ACTIVITY

Before Using the Pages

- Review the concept of dividing a whole into 2, 3, 4, 5, or 10 *equal* parts and the names given to these parts (halves, thirds, fourths, fifths, tenths). Use the display board with shapes that are divided into the corresponding number of equal parts. Have students point to shapes that show fractions that you name, such as three-fourths, one-half, seven-tenths, and two-thirds.

  Display a few shapes divided into 2, 3, 4, 5, and 10 *unequal* parts. Ask the students whether the shapes show halves, thirds, fourths, fifths, or tenths. Have them suggest reasons for their answers.

Using the Pages

- Briefly discuss that flags often show equal parts. Discuss the illustration of the flag of Canada. Review the term *fraction* and emphasize that fractions name amounts less than one if the whole is divided into *equal* parts. Discuss the significance of the upper and lower numerals of a fracti That is, the upper numeral names the number of "speci equal parts, and the lower numeral names the number equal parts in all for the whole. Another way of looking a fraction is that the upper numeral tells the number of pa we are thinking of, and the bottom numeral tells the s (name) of each part.

  You may wish to demonstrate the concept of fourths folding a rectangular sheet of paper in half and then in h again. The two outer fourths may be colored red. A ma leaf can be drawn in the remaining part.

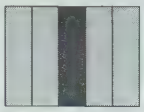
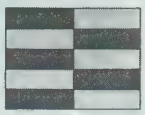
Working Together: These exercises establish the significa of the upper and lower numerals of a fraction and indic that it is best to determine the number of equal parts f and then the number of parts that are special. The f sub-skills dealt with are:

establish whether the shape shows equal parts;
count the equal parts;
count the special parts;
give the fraction.

Exercises

Write fractions to complete the chart.

	red part	yellow part
1.	$\frac{1}{5}$	$\frac{4}{5}$
2.	$\frac{1}{2}$	$\frac{1}{2}$
3.	$\frac{5}{10}$	$\frac{5}{10}$
4.	$\frac{2}{4}$	$\frac{2}{4}$
5.	$\frac{1}{4}$	$\frac{3}{4}$
6.	$\frac{2}{5}$	$\frac{3}{5}$
7.	$\frac{1}{3}$	$\frac{2}{3}$
8.	$\frac{7}{10}$	$\frac{3}{10}$
9.	$\frac{1}{2}$	$\frac{1}{2}$

1. 
2.
3. 
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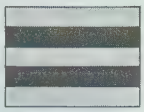
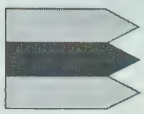
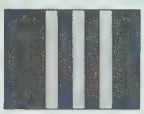
6. 
7. 
8. 
9.

Draw and color flags to show these fractions.
Try to make flags different from those shown above.

10. $\frac{2}{3}$ 11. $\frac{1}{2}$ 12. $\frac{4}{10}$ 13. $\frac{3}{4}$ 14. $\frac{5}{10}$ 15. $\frac{2}{5}$

try this

The flag for New Brunswick suggests the fractions $\frac{1}{3}$ and $\frac{2}{3}$.

Look at the flag for another province.

1. Does its design suggest any fraction? Answers will vary

Imagine a line through the ship's mast and it also suggests $\frac{1}{2}$.

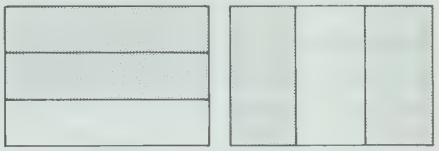
Look at other flags. Answers will vary

2. Do their designs suggest any fractions?

10 2 red parts, 1 yellow part
11 1 red part, 1 yellow part
12 4 red parts, 6 yellow parts
13 3 red parts, 1 yellow part
14 5 red parts, 5 yellow parts
15 2 red parts, 3 yellow parts

RELATED ACTIVITIES

- The flags for Ex. 10-15 on page 25 may be displayed to show different ways of dividing a whole into equal parts. For each flag, two fractions may be named; for example, for Ex. 10, $\frac{2}{3}$ is gray, $\frac{1}{3}$ is white.



ercises: You may wish to discuss Ex. 1 with the students by establishing that one of five equal parts is red, so the fraction is $\frac{1}{5}$. Also, four of five equal parts are yellow, so the fraction is $\frac{4}{5}$.

Have the students use a straight edge to draw the flags for Ex. 10-15. If you wish, give each student six small rectangular sheets of paper to show the answers for those exercises. Where practical, they may fold the paper to obtain the required number of equal parts for the whole and then color the parts.

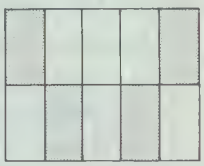
y This: Provide students with pictures of the flags for the ten provinces of Canada and for different countries of the world. They may sketch several of the flags and draw lines, if necessary, to show the fractions suggested. Have them write the corresponding fraction numerals.

Assessment

Write the fraction to show how much is white.

1.
$\frac{2}{4}$

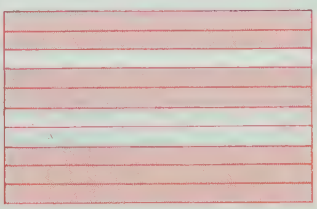
2.
$\frac{1}{2}$

3. 
$\frac{6}{10}$

Draw and color flags to show these fractions.

4. $\frac{3}{5}$ 5. $\frac{7}{10}$

Answers will vary, for example



Pages 26-27

LESSON OUTCOME

Read and write numerals for fractions less than one for part of a set (halves, thirds, fourths, fifths, tenths); draw diagrams to illustrate fractions less than one for part of a set

Materials

a straight edge and blue, red, yellow, and green crayons for each student

Vocabulary

names of the provinces of Canada

Prerequisite Skills

Write numerals for fractions less than one for part of a whole

Checking Prerequisite Skills

Write the fraction to show how much is shaded.

1. $\frac{1}{4}$

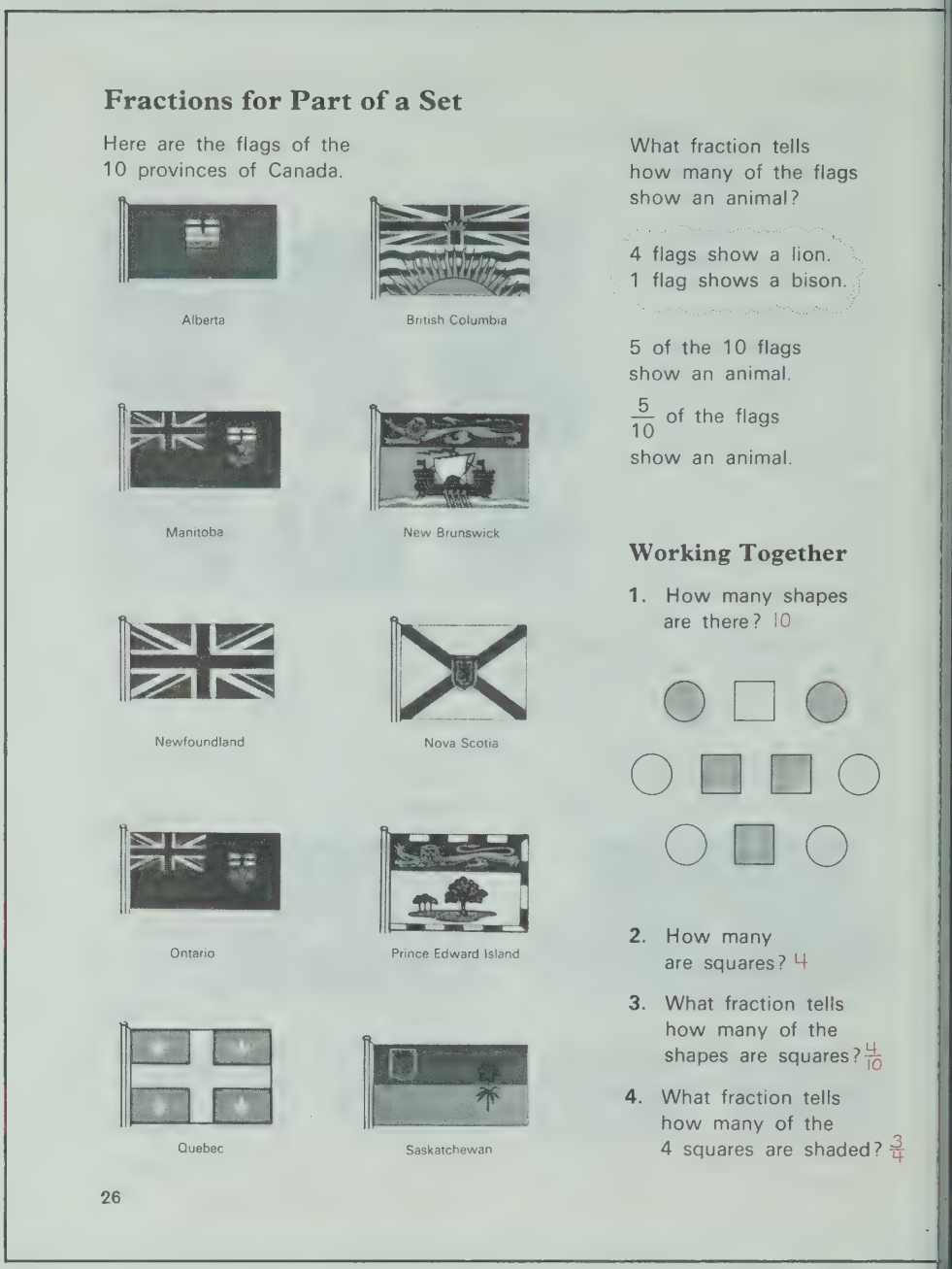
2. $\frac{3}{5}$

3. $\frac{7}{10}$

4. $\frac{1}{2}$

Background

The number of objects in a set is the same as the number in the denominator of the corresponding fraction. For example, halves would be shown in a set of two objects, fourths in a set of four objects, and so on.



Fractions for Part of a Set

Here are the flags of the 10 provinces of Canada.

Alberta

British Columbia

Manitoba

New Brunswick

Newfoundland

Nova Scotia

Ontario

Prince Edward Island

Quebec

Saskatchewan

26

What fraction tells how many of the flags show an animal?

4 flags show a lion.
1 flag shows a bison.

5 of the 10 flags show an animal.

$\frac{5}{10}$ of the flags show an animal.

Working Together

1. How many shapes are there? 10

2. How many are squares? 4

3. What fraction tells how many of the shapes are squares? $\frac{4}{10}$

4. What fraction tells how many of the 4 squares are shaded? $\frac{3}{4}$

LESSON ACTIVITY

Before Using the Pages

- Have students help to demonstrate fractions for part of a set in a manner similar to the following.

  Have three students stand at the front of the class, two of whom are wearing a color that the third student is not wearing. Ask how many students are in the group and how many are wearing (green). Ask what fraction tells the number of students in the group who are wearing (green). Then ask what fraction tells how many are not wearing (green).

  Hold up your two hands with fingers spread apart. Ask how many fingers (including thumbs) there are in all. Ask how many fingers have rings on them. Ask what fraction tells how many of the fingers have rings and what fraction tells how many fingers do not have rings.

  Use other similar examples as needed.

Using the Pages

- Have the students spend the first few moments studying the ten flags illustrated on page 26. Then have them suggest ways in which some of the flags are alike and ways in which they are different. Discuss the worked example that develops the fraction $\frac{5}{10}$. Emphasize the meaning of each numeral in the fraction. Students will likely note that equality is not involved in parts of a set as it is in parts of a whole. For part of a set, it is the number of objects in the set that is important.

Working Together: For part of a set, the steps that lead to a fraction are:

count the objects in the set;
count the special objects;
give the fraction.

These are the skills that are examined in Ex. 1-3. Help students think through similar steps for Ex. 4. For example, "How many squares are there in all?"

Exercises

Write a fraction to answer each question about the set of 10 provincial flags.

1. How many flags show red? $\frac{9}{10}$
2. How many flags snow blue? $\frac{8}{10}$
3. How many show green? $\frac{5}{10}$
4. How many show white? $\frac{10}{10}$
5. How many show yellow or gold? $\frac{7}{10}$
6. How many show a shield? $\frac{5}{10}$
7. How many show a lion? $\frac{4}{10}$
8. How many show a bison? $\frac{1}{10}$
9. How many show a plant? $\frac{4}{10}$
10. How many show a ship? $\frac{1}{10}$
11. How many flags contain this design? $\frac{6}{10}$
12. How many flags contain this design? $\frac{5}{10}$

Answers may vary for Ex 9.

There are 5 flags showing animals. What fraction tells how many of these

13. show a lion? $\frac{4}{5}$
14. show a bison? $\frac{1}{5}$

These 4 provinces are known as Atlantic Canada.

New Brunswick	Newfoundland
Nova Scotia	Prince Edward Island

What fraction of the flags of Atlantic Canada

15. show blue? $\frac{3}{4}$
16. show a plant? $\frac{1}{4}$
17. suggest the sea? $\frac{1}{4}$ (Answers may vary.)

These 3 provinces are known as the Prairie Provinces.

Alberta	Manitoba
Saskatchewan	

What fraction of the flags of the Prairie Provinces

18. show white? $\frac{3}{3}$
19. show a flower? $\frac{1}{3}$
20. suggest the prairies? Answers may vary.

Draw and color pictures for each of these.

21. 5 flags, $\frac{1}{5}$ showing blue, $\frac{4}{5}$ showing red
22. 4 flags, $\frac{2}{4}$ showing , $\frac{2}{4}$ showing
23. 3 flags, $\frac{2}{3}$ showing a flower, $\frac{1}{3}$ showing an animal

*24. 10 flags, $\frac{3}{10}$ showing yellow, $\frac{4}{10}$ showing white

*25. 5 flags, $\frac{3}{5}$ showing green, $\frac{4}{5}$ showing a flower

*26. 10 flags, $\frac{2}{10}$ showing , $\frac{5}{10}$ showing blue, $\frac{7}{10}$ showing just two colors

Answers will vary for 21-26

RELATED ACTIVITIES

- Students may work in groups of 4, 5, or 10 to practice fourths, fifths, and tenths of a set. Each student should prepare her/his own set of three cards, one blue, one red, and one green. The students sit in a circle. When the appointed leader says, "Show", each player places any one card on the floor to show the selected color. Then the number of cards of each color is determined and each student writes the fractions to tell what part of the set of cards is green, what part is red, and what part is blue. In this activity, students may encounter such fractions as $\frac{0}{4}$ and $\frac{5}{5}$.
- Since answers will vary for Ex. 21-26 on page 27, students may enjoy having the different solutions displayed for several days.

"How many of the squares are shaded?"
"What fraction tells how many of the squares are shaded?"
Students can refer to the diagram for Ex. 1 to write fractions for other similar exercises. For example, you could have the students state what fraction tells how many shapes are circles and what fraction tells how many circles are shaded.

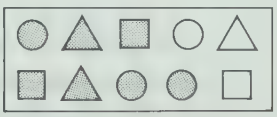
rcises: The exercises are grouped according to the number of objects in the set. Thus, Ex. 1-12 involve tenths, Ex. 13 and 14 involve fifths, Ex. 15-17 involve fourths, and Ex. 18-20 involve thirds.

For each of Ex. 21-26, the students should draw the shapes for the required number of flags and then complete the flags according to the fractions and the instructions. Remind them to use a straight edge to draw their flags. Note that the sum of the fractions in each of Ex. 24-26 does not equal one because one flag may show more than one given color or attribute.

Assessment

Write a fraction that tells

1. how many shapes are shaded.



$\frac{7}{10}$

2. how many shapes are squares.

$\frac{1}{5}$

3. how many shapes show .

$\frac{2}{3}$

Draw and color pictures. Answers will vary.

4. 5 flags, $\frac{2}{5}$ showing blue, $\frac{3}{5}$ showing red.
5. 4 flags, $\frac{1}{4}$ showing , $\frac{3}{4}$ showing .

LESSON OUTCOME

Read and write numerals in mixed form for numbers less than ten (halves, thirds, fourths, fifths, and tenths)

Materials

display board, cutouts for wholes and parts of a whole, several small objects, identical containers such as small boxes or paper cups

Vocabulary

names of mixed numbers less than ten for halves, thirds, fourths, fifths, and tenths

Prerequisite Skills

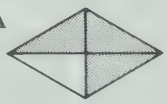
Read and write numerals for fractions less than one for halves, thirds, fourths, fifths, and tenths

Checking Prerequisite Skills

Match each picture with the fraction that tells how much is shaded.

1. $\frac{2}{10}$ E
2. $\frac{1}{3}$ C
3. $\frac{3}{5}$ B
4. $\frac{3}{4}$ A
5. $\frac{1}{2}$ D

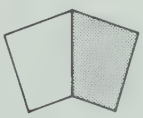
A



B

C

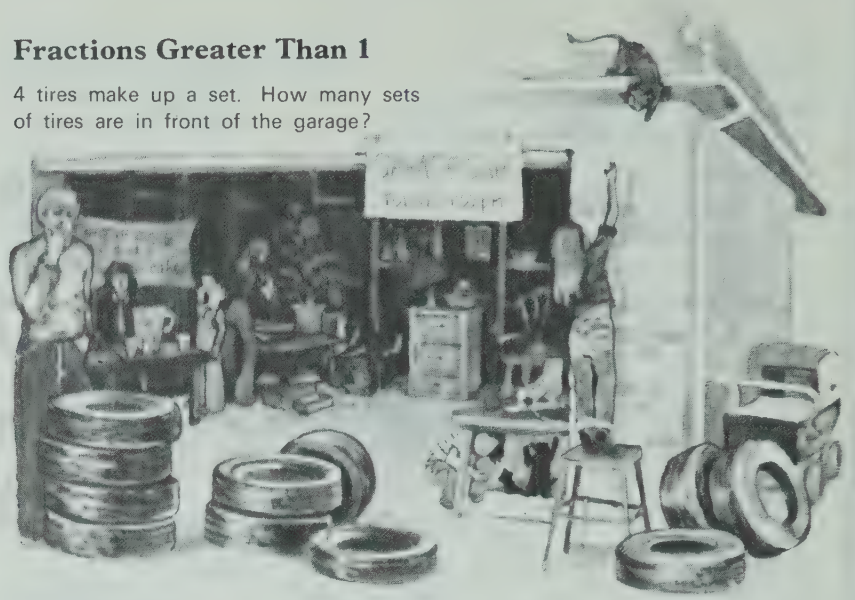
D



E

Fractions Greater Than 1

4 tires make up a set. How many sets of tires are in front of the garage?



2 sets of tires

3 of 4 tires of another set

There are $2\frac{3}{4}$ sets of tires in front of the garage.

two and three-fourths sets of tires

Exercises

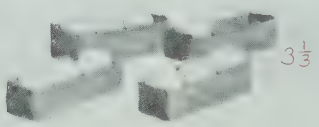
Write fractions to answer the following questions.

4 tires to a set. How many sets of tires?

1.

2.

3 golf balls to a box. How many boxes of golf balls?

3. 

4.

LESSON ACTIVITY

Before Using the Pages

- Use the display board with circular cutouts to illustrate mixed numbers such as $5\frac{1}{2}$ and $2\frac{3}{4}$. For example, place one cutout on the board and ask how many are shown. Repeat the question as you place each of four more identical cutouts on the display board. Then place a cutout that is one-half the circular shape with the others and repeat the question. Provide an opportunity for students to manipulate the shapes, if necessary, to verify whether the fractional part is $\frac{1}{2}$, $\frac{1}{3}$, and so on, of the original circular shape.

  Use several objects in containers to demonstrate mixed numbers for part of a set. For example, display 12 objects and several identical containers, such as small boxes or paper cups. Tell the students that each container can hold, say, 5 objects. Have students help to place the objects in the containers. Discuss that there are not enough for there to be a complete set in the third container. Develop that there are $2\frac{2}{5}$ sets. Use other examples as needed.

Using the Pages

- Discuss that many objects come in sets, such as golf c… mittens, and tires. Lead the students through the wo… example, emphasizing that one set of tires consists of … tires, and that an incomplete set can be represented … fraction less than one (as fourths). Draw attention t… numeral $2\frac{3}{4}$ and discuss the significance of each part: … the two complete sets of tires, and $\frac{3}{4}$ for 3 of 4 tire… another set. Thus, the numeral $2\frac{3}{4}$ represents a w… number *and* a fraction less than one. Write the numer… on the board, emphasizing that the numeral 2 for the w… number part is written as a large numeral, whereas … numerals 3 and 4 for $\frac{3}{4}$ are smaller. Also, point out tha… fraction bar is horizontal, not slanted.

  Have the students place a hand over one complete s… tires and give the mixed number that names the numb… sets. Have a student write the numeral $1\frac{3}{4}$ on the boa…

Exercises: Suggest that the students first determine the v… number part of each answer by counting the complete…

2 bookends to each pair.
How many pairs?

5. $2\frac{1}{2}$ 6. $1\frac{1}{2}$

10 crayons to each box.
How many boxes of crayons?

9. $2\frac{5}{10}$ 10. $1\frac{8}{10}$

5 bowls in each stack.
How many stacks of bowls?

11. $2\frac{3}{5}$ 12. $1\frac{4}{5}$

How many glasses of juice?

13. $2\frac{2}{3}$ 14. $1\frac{1}{2}$ 15. $3\frac{1}{4}$

How many pairs of skates?

16. $2\frac{1}{2}$ 17. $1\frac{1}{2}$

10 cards to a set.
How many sets of cards?

7. $4\frac{7}{10}$ 8. $2\frac{2}{10}$

How many apples?

18. $4\frac{1}{2}$ 19. $3\frac{3}{4}$

4 eggs for each cake.
How many cakes can be made?

*23. 2 (1 egg left over)

Draw a picture
to show each amount.

20. $2\frac{3}{4}$ doughnuts
21. $3\frac{1}{2}$ cookies
22. $4\frac{1}{3}$ stacks with
3 blocks in each stack

5 tomatoes for each carton.
How many cartons are needed?

*24. 4 (3 full cartons and 1 tomato in the fourth carton)

29

RELATED ACTIVITIES

• You may wish to adapt the activity in *Related Activities* on page T 27 for mixed numbers less than ten. For fifths, for example, each of five players (except the leader) has one whole set of five and one-fifth of a set. The leader has five whole sets and no fifths. Sets may consist of five beads on a string or a pipe cleaner, five sticks tied with a rubber band, and so on. When the leader says, "Show", each player places one or more of her/his pieces on the floor. Each student writes the mixed number shown. Mixed numbers up to $9\frac{4}{5}$ are possible with five players. For thirds and fourths, the number of players should be three and four, with mixed numbers up to $5\frac{2}{3}$ and $7\frac{3}{4}$ being possible. For tenths, use up to nine sets of ten and up to nine items (tenths) distributed randomly among any number of players, for mixed numbers to $9\frac{9}{10}$.

(or whole objects). Then they may consider the fraction for part of the set (or part of the whole). Some students may need assistance with Ex. 22. Help them by asking questions such as, "For four and one-third stacks, how many complete stacks are there?" "How many blocks are needed for each complete stack?" "For one-third stack, how many blocks will you draw?"

Ex. 23 and 24 are starred. These illustrate that in practical cases, the mixed number is not a sensible answer. For Ex. 23, for example, two cakes can be made but there are not enough eggs for three cakes; for Ex. 24, four cartons will be needed because one extra carton will be needed for the extra tomato.

sessment

te fractions to answer the questions.

How many oranges are there?

$3\frac{1}{2}$

2. How many packages of chalk are there?

$2\frac{3}{5}$

Draw a picture to show each amount.

3. $4\frac{1}{4}$ cookies

4. $3\frac{6}{10}$ bags of marbles with 10 marbles in each bag

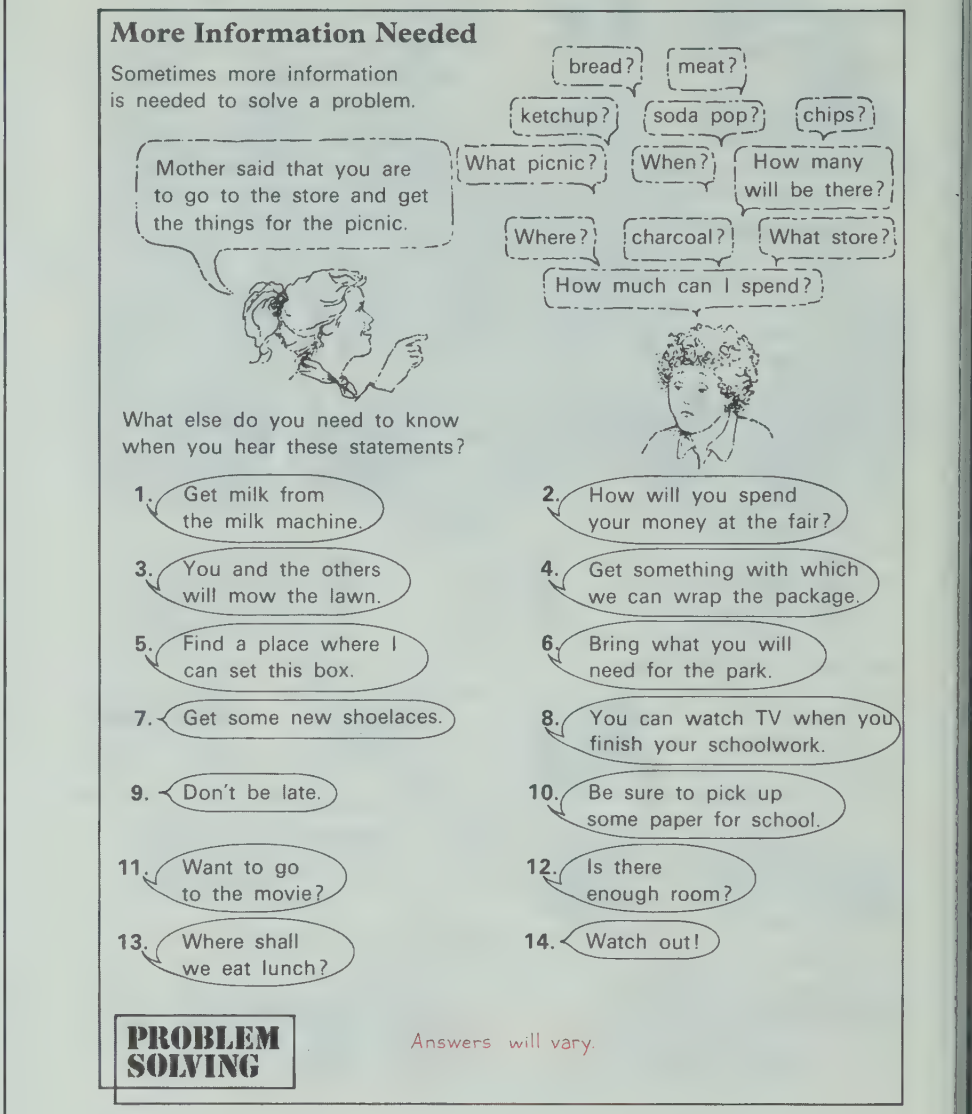
Page 30

OBJECTIVE

Determine additional information that may be required to solve a problem

RELATED ACTIVITIES

- Some students may be interested in writing problems for which more information is needed. These may be written on cards and placed in a box. Students may draw a card from the box and consider the questions that might be asked to obtain more information.


More Information Needed
Sometimes more information is needed to solve a problem.
Mother said that you are to go to the store and get the things for the picnic.
bread?
meat?
ketchup?
soda pop?
chips?
What picnic?
When?
How many will be there?
Where?
charcoal?
What store?
How much can I spend?
What else do you need to know when you hear these statements?
1. Get milk from the milk machine.
2. How will you spend your money at the fair?
3. You and the others will mow the lawn.
4. Get something with which we can wrap the package.
5. Find a place where I can set this box.
6. Bring what you will need for the park.
7. Get some new shoelaces.
8. You can watch TV when you finish your schoolwork.
9. Don't be late.
10. Be sure to pick up some paper for school.
11. Want to go to the movie?
12. Is there enough room?
13. Where shall we eat lunch?
14. Watch out!
PROBLEM SOLVING
Answers will vary.
30

LESSON ACTIVITY

Before Using the Page

- Begin by asking several questions and/or assigning several tasks for which insufficient information is given. Some examples are:
  "How many of you are going to the party?"
  "Give three to each person in the group."
  "How much of it did the dog eat?"
  The students will likely be rather confused and begin to ask questions. Comment on the questions they ask.

Using the Page

- Have a student read the title and the statements at the top of the page. Have students suggest what questions they might ask in order to find out the information they would need to know. Compare their ideas with those shown on the page.
- Since these exercises lend themselves to discussion, it suggested that answers be considered orally instead o writing. For larger groups of students, you may guide discussion and consider the exercises in any order. order could be determined by the interests of the stud after they have a few minutes to read the problems.

  For smaller groups of students, each student has m opportunity to participate in the discussion. The stud might work in groups of two or three on different proble Later, each group could present their solutions and, wh practical, demonstrate them in the form of a short play

Checking Up

Think of a place-value chart to help you answer these questions.

1. What does the 8 mean in 658 923? 8 thousands
2. What does the 9 mean in 97 573? 9 ten thousands
3. What does the 7 mean in 724 195? 7 hundred thousands
4. What does the 0 mean in 204 157? 0 ten thousands

Write the standard form.

5. six hundred ninety-two thousand three hundred seventy-one 692 371
6. three hundred six thousand 306 000
7. fifty-four thousand thirty-two 54 032
8. 300 000 + 2 000 + 50 + 7 302 057
9. 235 thousand 308 235 308
10. 2 thousands 4 hundreds 7 tens 2470
11. LXXIV 74

Write the expanded form.

12. 37 508
13. 405 095

Write the words.

14. 83 881
15. 602 019

Use > or < to make true statements.

16. 44 172 < 441 472
17. 323 419 > 303 499
18. 385 756 > 385 753

List the numbers from greatest to least.

19. 324 425, 324 254, 325 452, 34 452, 342 542, 324 252
342 542, 325 452, 324 425, 324 254, 324 252, 34 452

Round to the nearest ten.

20. 27 30
21. 633 630

Round to the nearest hundred.

22. 748 700
23. 2992 3000

Round to the nearest thousand.

24. 2499 2000
25. 3501 4000

Answer the question.

26. What is the first word on the 200th page of this book? Rounding (or Multiplying)

Write the fraction that shows

27. how much pie is left. $\frac{4}{5}$
28. how many are squares. $\frac{7}{10}$
29. how many boxes of golf balls there are. $3\frac{2}{3}$
30. how much is shaded. $2\frac{1}{4}$

12. 30 000 + 7 000 + 500 + 8
13. 400 000 + 5 000 + 90 + 5
14. eighty-three thousand eight hundred eighty-one
15. six hundred two thousand nineteen

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Many students benefit from reading numerals aloud. Have them read the numerals in Ex. 1-4 and Ex. 12-25. Others may benefit by showing these numerals on an abacus.
- For further practice with ordinal numbers, use other exercises similar to Ex. 26; for example, "What is the seventh word on the 161st page of this book?"
- The second activity in *Related Activities* on page T 7 may be adapted for showing six-place numerals.
- The digital device described in *Related Activities* on page T 11 may be used to play the game "Show Me". One example would be, "Show me seventeen thousand eight hundred twenty."

lls	Exercises	Related Pages
erpret place value in numerals	1-4	T 18-T 19
ite numerals in standard form	5-9	T 18-T 19
	10	T 10-T 11
	11	T 22-T 23
ite numerals in expanded form	12, 13	T 18-T 19
ite words for numerals	14, 15	T 18-T 19
mpare numbers	16-18	T 20-T 21
der numbers	19	T 20-T 21
und numbers	20-25	T 14-T 15
erpret ordinal numbers	26	T 16-T 17
ite fractions, part of a whole	27	T 24-T 25
ite fractions, part of a set	28	T 26-T 27
ite fractions greater than 1	29, 30	T 28-T 29

Comments

The chart showing the skills required for the exercises on this page is helpful in locating an area of difficulty.

Some students may have difficulty placing zeros in the numerals for Ex. 6-8 and Ex. 10. Work with place-value charts and an abacus may be helpful. Students having difficulty with rounding numbers may benefit from counting by tens, hundreds, and thousands. For example, for Ex. 21, counting by tens from 600 (600, 610, 620, 630, 640) helps students to locate 633 between 630 and 640, and then to determine which is closer to 633. Similarly, counting by hundreds for Ex. 23 (2600, 2700, 2800, 2900, 3000) helps in rounding 2992 to the nearest hundred.

Some students will consider page 200 as the 200th page of this book for Ex. 26. Other students will consider the unnumbered pages at the front of the book as well, thus, two answers are possible.

Unit 2 Overview

Addition

This unit deals exclusively with addition and begins with a review of basic addition facts. Then the algorithm (the arrangement of numerals in vertical form) used in addition is reviewed and extended to three four-place addends. Rounding of numbers to the nearest hundred and to the nearest thousand is applied in estimating sums.

The problem-solving skill in this unit is again related to real life. Whereas in Unit 1 the problems had insufficient information, in this unit, problems have more information than is required to solve them. This demands skill in selecting some data and eliminating other data before solving the problems. Careful reading is involved to determine the essential information for each particular problem.

A quick method of checking the accuracy of addition is presented in one of the *Try This* features of the unit. The technique uses the sum of the digits in each numeral and resembles closely the familiar "casting-out-nines" method.

Prerequisite Skills

- interpret place value for numerals with up to four digits

Unit Outcomes

- complete the basic addition facts and patterns in addition tables for basic addition facts
- add two numbers with regrouping, sums to 9999
- add three numbers with regrouping, sums to 9999
- estimate a sum by rounding each addend to the nearest ten, hundred, or thousand
- solve word problems involving addition
- select the necessary information for solving a problem, and then solve the problem

Background

Addition is a *binary* operation; that is, only two numbers can be combined at one time. If three addends are involved, two of the numbers can be combined to form a new number called their sum. This number is then combined with the third number to produce the sum of the three numbers. This procedure may be repeated as many times as the number of addends requires.

Two basic properties are involved in the operation of addition. The *commutative property of addition* states that the order of two addends may be reversed without affecting their sum.

$8 + 9 = 17$
$9 + 8 = 17$

$$\begin{array}{r} 389 \\ +\ 273 \\ \hline 662 \end{array} \qquad \begin{array}{r} 273 \\ +\ 389 \\ \hline 662 \end{array}$$

The *associative property of addition* states that the order of grouping addends when there are more than two does not affect their sum.

$(8 + 9) + 4 = 17 + 4 = 21$ $\qquad$ $8 + (9 + 4) = 8 + 13 = 21$

Accuracy may be checked using the commutative property by adding two numbers in opposite directions, but since the basic facts are virtually the same each time ($3 + 9 = 12$ and $9 + 3 = 12$), the same error may be repeated and be undetected. On the other hand, the associative property is better for checking as it permits more than two addends to be arranged in any order. Thus, the sum of 389, 273, and 765 is the sa every time.

$$\begin{array}{r} 389 \\ 273 \\ +\ 765 \\ \hline 1427 \end{array} \qquad \begin{array}{r} 273 \\ 765 \\ +\ 389 \\ \hline 1427 \end{array} \qquad \begin{array}{r} 765 \\ 389 \\ +\ 273 \\ \hline 1427 \end{array}$$

As a method of checking, adding in opposite directi involves different basic facts and extensions for each directi For example, in the first exercise above, adding the o downward gives $9 + 3 = 12$ and $12 + 5 = 17$, where adding upward gives $5 + 3 = 8$ and $8 + 9 = 17$.

Regrouping 10 tens as 1 hundred and 10 hundreds as thousand are involved in the work of this unit. It is import that students understand that a number has many names, some them very simple and some not. For example, the number *one hundred twenty-eight* in its simplest, or standard, form represented by the numeral 128 which shows 1 hundred 2 ten ones. But the same number can also be represented in ot ways, three of which are shown here.

hundreds	tens	ones
1	2	8
	12	8
1	1	18
	11	18

Since our numeration system is a base-ten system, the th irregular forms are readily converted to the standard form regrouping. Thus, whenever a sum greater than nine is reach it is regrouped in terms of ten or more, and 1 is added to the n higher place value. Although these extra 1's are shown in t unit and students should use them at first to show the regroup in their addition, students should also be encouraged to try eliminate this procedure by merely thinking of an extra 1 as th add the next column. In this unit they also meet situations wh the regrouping involves a 2 rather than a 1, particularly wh there are three addends. The sum of the ones in the exam shown is 22, which is regrouped as 2 tens 2 ones, with a 2 ad in the tens' column.

$$\begin{array}{r} 3209 \\ 1765 \\ +\ 2098 \\ \hline 7072 \end{array}$$

Teaching Strategies

It is important for students to have complete mastery of all basic addition facts at this stage. Any errors or hesitation recall can not only impede progress, but can also deny succ and enjoyment which should be experienced. Therefore, tim or dictated tests are suggested at the beginning of the unit survey the individual strengths and weaknesses of the learne These should be followed by appropriate practice. In t connection it is recommended that basic addition facts be trea in pairs, when the addends are different. For examp $9 + 7 = 16$ and $7 + 9 = 16$ should be practiced together that they are mastered equally well in either order.

Note that in column addition with three or more adden there are unseen addends, which are the sums obtained en ro before the last step. Sometimes students have difficulty keepi these unseen addends in mind while they read the printed written addends. Since extensions of basic facts are frequen

olved, it may be helpful for students to practice these and ome familiar with patterns such as the following.

7 + 6 = 13	2 + 7 = 9	3 + 8 = 11
17 + 6 = 23	12 + 7 = 19	13 + 8 = 21
27 + 6 = 33	22 + 7 = 29	23 + 8 = 31

n the example shown below, for instance, adding upward in ones' column gives 6 + 7 = 13 and 13 + 8 = 21. Simi- y, adding upward in the hundreds' column gives 9 + 8 = 17 17 + 6 = 23.

$$\begin{array}{r} 628 \\ 807 \\ +\ 916 \\ \hline 2351 \end{array}$$

Students who require assistance with regrouping sums should rk together and have access to materials such as models of usands, hundreds, tens, and ones, place-value pocket charts, peg abaci. The latter two aids are inexpensive, particularly if suggestions for making them on page T 344 are followed. ditional devices and activities which the students may use are cribed in the *Related Activities* for lessons in this unit.

t is suggested that the teacher study carefully the results of *Checking Up* exercises on page 51. The chart on page T 53 y be used to identify specific strengths and weaknesses. The dents should then be grouped accordingly and given propriate reteaching and practice.

terials

dels for thousands, hundreds, tens, and ones
e-by-five section of graph paper cut from copies of page T 367 for each student
e copies of page T 361 for each student
ce-value pocket chart, several abaci (four places)
mber line for the numbers from 0 to 100

cabulary

dition table	sum, add, plus	roundup
tical form	regroup	equals
n numbers	estimate	addends
l numbers	cattle, rancher	kilograms, kg

Pages 32-33

LESSON OUTCOME

Complete the basic addition facts; complete patterns in addition tables for basic addition facts

Materials

five copies of page T361 for each student (or $2\frac{1}{2}$ copies of page T367), copies of page T349 (optional)

Vocabulary

sum, add, equals, plus, =, +, addition table

2 ADDITION

Basic Facts

There are 6 large rabbits.
There are 7 small rabbits.
How many rabbits are there in all?

Add 6 and 7.

$$\begin{array}{r} 6 \\ +\ 7 \\ \hline 13 \end{array} \qquad \begin{array}{r} 7 \\ +\ 6 \\ \hline 13 \end{array}$$

$6 + 7 = 13$ $\qquad$ $7 + 6 = 13$

There are 13 rabbits in all.

Exercises

Add.

1. $5+4$ 9	2. $8+3$ 11	3. $2+7$ 9	4. $5+6$ 11	5. $8+7$ 15
6. $2+1$ 3	7. $0+5$ 5	8. $9+9$ 18	9. $1+6$ 7	10. $3+2$ 5
11. $4+2$ 6	12. $6+7$ 13	13. $8+0$ 8	14. $9+8$ 17	15. $8+6$ 14
16. $8+5$ 13	17. $4+7$ 11	18. $9+0$ 9	19. $4+3$ 7	20. $2+9$ 11

21. 9 + 4 = 13	22. 3 + 6 = 9	23. 7 + 7 = 14	24. 0 + 4 = 4	25. 6 + 9 = 15	26. 4 + 8 = 12
27. 8 + 9 = 17	28. 8 + 4 = 12	29. 9 + 5 = 14	30. 5 + 5 = 10	31. 5 + 1 = 6	32. 6 + 8 = 14
33. 5 + 7 = 12	34. 7 + 3 = 10	35. 6 + 4 = 10	36. 6 + 6 = 12	37. 5 + 3 = 8	38. 3 + 9 = 12

32

LESSON ACTIVITY

Using the Pages

- Determine whether any of the students have lived on or visited a farm. Ask what animals are often seen on a farm. Discuss that there is usually more opportunity to raise certain animals as pets, for example, rabbits, if one lives on a farm.

  Have a student read the problem at the top of page 32. Discuss that although counting the rabbits one by one will give the answer 13, it is much more efficient to know from memory what number is obtained when 6 and 7 are added. Review that addition is used to find the answer to the question, "How many rabbits are there in all?" Ask how many rabbits there would be if there were, for example, 6 large rabbits and 4 small rabbits, or 9 large rabbits and 0 small rabbits.

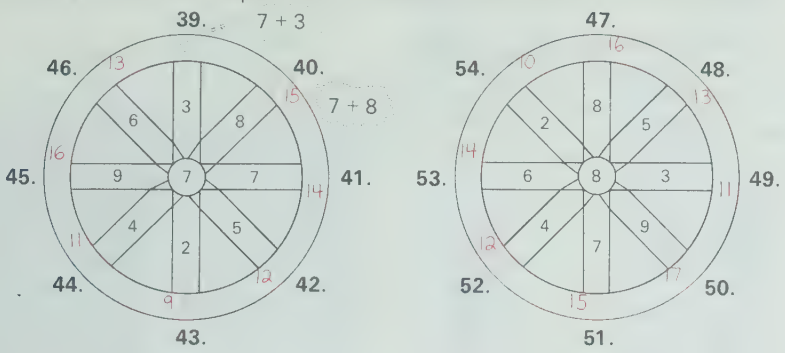
  The example illustrates both the horizontal form and the vertical form for addition. Draw both forms to the students' attention and have them identify the symbols for *plus* (+) and *equals* (=). Have students read the number sentenc aloud.

  The example also illustrates an important property addition known as the order (commutative) property. T is, the order of adding two numbers does not change sum. Thus, the number of rabbits in all can be found fr 6 + 7 or from 7 + 6. Discuss this aspect of addition w the students, emphasizing that the answers are the sa although the order of the numbers is reversed. Ask w name is given to the result of addition and have them sea for the word *sums* on the pages.

Exercises: Most students will likely understand what is requi for the exercises on page 32. Note that the + signs are required for exercises in the vertical form (Ex. 21-38) si the instruction "Add" appears at the beginning. T emphasis for these exercises should be accuracy w speed.

Spend a few moments discussing the exercises on pa 33 to ensure that the students understand the procedure completing the number wheels and the addition tabl

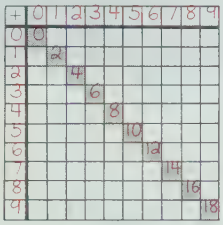
Write the sums that complete each wheel.



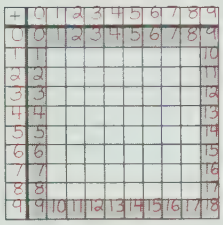
Use grid paper. Set up four addition tables like this. Fill in the sums to match these patterns.

+	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

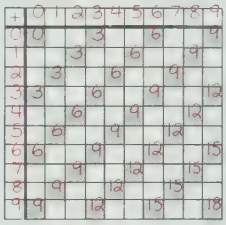
55.



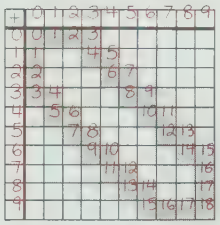
56.



57.



58.



59. Make up and color your own pattern in an addition table. Give it to a friend.
Answers will vary.

33

RELATED ACTIVITIES

- The students' patterns for Ex. 59 would make an interesting display and would provide an opportunity for all students to write the sums for many different patterns.
- Some students may be interested in preparing number wheels for other students to complete. (Copies of page T 360 may be used.)
- It is important to provide opportunities for students to improve their speed in completing basic addition facts with accuracy. Frequent timed tests can help students to improve their scores and would help you and each student to identify facts which require review and further practice. Tests can involve random basic facts or they can be organized to practice sums with a particular number as an addend, for example, 9.
- Two students may play a game using a number spinner for 0 to 9, two pencils of different colors, and a copy of page T 349. Each player, in turn, spins the spinner twice to obtain two addends and then colors inside an appropriate square for their sum. If all the squares for a particular sum have been used, the player cannot color inside a square for that sum. At the end of an agreed number of rounds, the winner is the player with the most squares marked in her/his color.

Give each student five copies of page T 361 (or $2\frac{1}{2}$ copies of page T 367) to show their answers for Ex. 55-59. To help students plan patterns for Ex. 59 you may wish to provide them with copies of the addition table on page T 349. Some students may need to be shown that for the tables, the first addend is selected from the left column, and the second addend is selected from the top row. These exercises encourage students to observe patterns in numbers which, in turn, can lead to a better understanding of numbers and operations.

When the students have finished Ex. 55-59, it would be beneficial to review the effect of adding 0 to a number. Also, have students describe in their own words the patterns they observed in Ex. 55-58.

Assessment

Add.

1. 7 + 8 15 **2.** 4 + 8 12 **3.** 5 + 4 9

4. 7 + 6 13 **5.** 9 + 8 17 **6.** 9 + 6 15

7. 7 + 9 = 16 **8.** 2 + 8 = 10 **9.** 8 + 8 = 16 **10.** 4 + 7 = 11

Pages 34-35

LESSON OUTCOME

Add numbers with no regrouping and with regrouping ones as tens, sums to 99

Materials

models for tens and ones and/or a place-value pocket chart (optional)

Vocabulary

addends, regroup, vertical form

Prerequisite Skills

Complete the basic addition facts; interpret place value for two-digit numerals

Checking Prerequisite Skills

1. 8 + 7 15 **2.** 3 + 8 11

3. 4 + 6 10 **4.** 9 + 7 16

5. 9 + 9 18 **6.** 7 + 5 12

Complete.

7. 23 = 2 tens 3 ones

8. 32 = 3 tens 2 ones

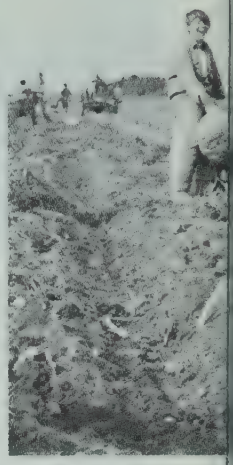
9. 69 = 6 tens 9 ones

10. 14 = 1 ten 4 ones

Addition, Regrouping Ones

Lee filled 26 baskets with potatoes.
Ray filled 18 baskets with potatoes.
How many baskets did they fill?

Add 26 and 18.



tens	ones
2	6
1	8

Show the **addends**, 26 and 18, in vertical form.

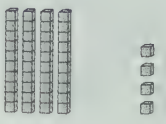
Add the ones.

	1	
2	6	
1	8	
	4	

Regroup 14 ones as 1 ten and 4 ones. Show the 1 ten lined up with the other tens.

	1	
2	6	
1	8	
4	4	

Add the tens.



Lee and Ray filled 44 baskets with potatoes.

34

LESSON ACTIVITY

Before Using the Pages

- Present a few examples of addition with no regrouping for sums to 99, and have students explain the addition at the board. For example, for the first exercise, the sum of 3 ones and 6 ones is 9 ones, and the sum of 2 tens and 4 tens is 6 tens. The number represented by 6 tens 9 ones is 69.

tens	ones
2	3
+ 4	6

5	7
+ 2	1

1	2
+ 8	3

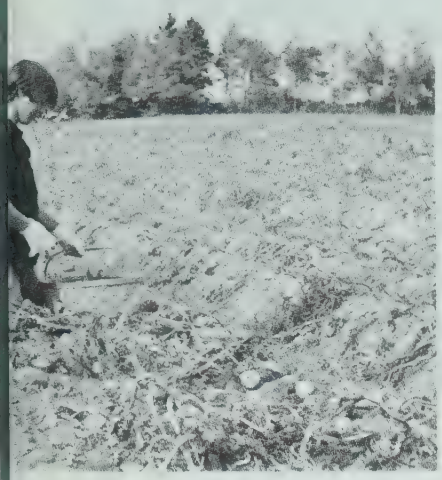
- Work several regrouping exercises, similar to the following, on the board to review regrouping 10 to 18 ones as one more ten and some ones. Support the examples using models of tens and ones and/or a place-value pocket chart as needed. Emphasize that the two forms for each exercise name the same number because 10 ones equal 1 ten.

tens	ones	
	~~14~~	
1	4	14
~~3~~	~~17~~	
4	7	47

Using the Pages

- Briefly discuss that some farms specialize in growi vegetables. Ask what vegetable is being harvested in photograph. Have a student read the problem at the top page 34. Discuss that the solution is found by addition sin we wish to find the number of baskets in all.

  A discussion of each step of the solution is facilitated the red on the numerals and by the illustrations of tens a ones. As you lead a discussion of the steps, question students as to what is meant by the terms *addends*, *verti form*, and *regroup*. Emphasize that since we cannot sh more than 9 ones, it is necessary to regroup 10 ones as o more ten. Have a student explain where this new ten



Exercises

Add.

1. 57 + 37 94
2. 24 + 75 99
3. 26 + 47 73
4. 43 + 16 59
5. 58 + 27 85
6. 23 + 58 81

7. 39 + 27 = 66
8. 38 + 46 = 84
9. 61 + 23 = 84
10. 15 + 39 = 54
11. 59 + 18 = 77
12. 45 + 48 = 93
13. 42 + 19 = 61
14. 28 + 28 = 56
15. 18 + 61 = 79
16. 27 + 35 = 62
17. 32 + 18 = 50
18. 17 + 64 = 81

Solve.

19. 47 potatoes in Lee's basket. 46 potatoes in Ray's basket. How many potatoes in both baskets? 93
20. 18 potatoes from one hill. 14 from another hill. How many potatoes from both hills? 32
21. 36 potato hills in one row. 35 in another row. How many hills in both rows? 71
22. 24 rows of potatoes in one field. 38 rows of potatoes in another. How many rows of potatoes in both fields? 62
23. The boys sold a small sack of potatoes for 39¢. They sold a larger sack for 56¢. How much did they get for both sacks? 95¢

Working Together

Regroup the ones.

1. 13 ones = 1 ten 3 ones
2. 15 ones = 1 ten 5 ones

Regroup the ones and complete the addition.

3. 38 + 55 = 93
4. 16 + 29 = 45

Add.

5. 47 + 29 = 76
6. 74 + 13 = 87
7. 48 + 39 = 87

35

RELATED ACTIVITIES

• The game described in *Related Activities* on page T35 may be made more challenging by having students use a blank addition table for basic facts (see page T361). As a further challenge, the addends may be written in random order as shown below.

+	7	3	6	9	8	2	4	0	5	1
6										
0										
3										
9										
1										
5										
8										
2										
4										
7										

• Some students may benefit from practice with addition in the following form.

$$\begin{array}{r} 6\ 2 \\ +\ 1\ 9 \\ \hline 8\ 1 \end{array}$$

shown in the solution. Emphasize that the dotted numeral 1 in 14 ones indicates that we do not write the 1 for 14 but merely think it. Have a student read the concluding statement.

rking Together: To add with regrouping, students must first be secure with the skill of regrouping 10 ones as 1 ten. This skill is examined in Ex. 1 and 2. Use other similar exercises as needed. In Ex. 3 and 4, the sum of the ones is given, and students can concentrate on the skill of regrouping in the context of addition. When the students work Ex. 5-7, ensure that they understand that the dotted numeral 1 is thought of but not written. Some students may not need to show the new ten as a small numeral above the tens' place if they can remember it.

ercises: A few of these will require no regrouping. Remind the students to show Ex. 1-6 in vertical form.

Assessment

Add.

1. 27 + 45 72
2. 38 + 19 57
3. 63 + 32 95
4. 26 + 26 = 52
5. 45 + 19 = 64
6. 56 + 28 = 84

Pages 36-37

OBJECTIVE

Demonstrate competence in addition with no regrouping and with regrouping ones as tens, sums to 99; solve related word problems

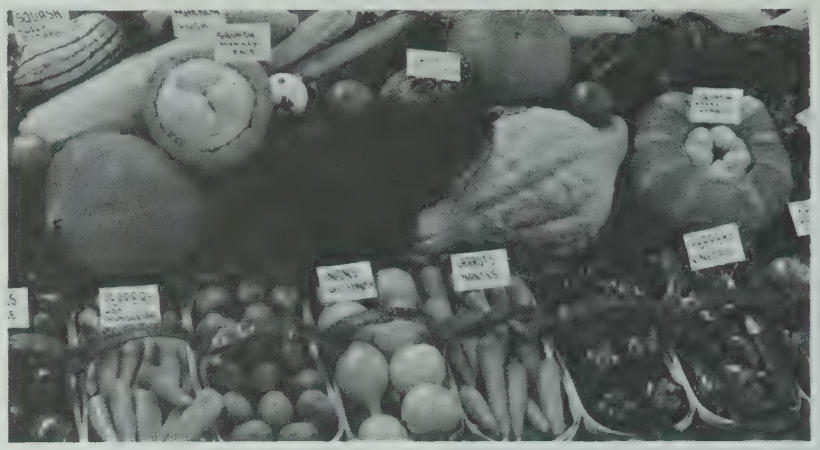
Materials

a five-by-five section of graph paper for each student cut from copies of page T 367

Vocabulary

even numbers, odd numbers

Practice



Solve.

1. 28 red peppers.
   27 green peppers.
   How many peppers? 55

2. 45 green squash.
   38 yellow squash.
   How many squash? 83

3. 26 white onions.
   58 red onions.
   How many onions? 84

4. 54 green cabbages.
   39 red cabbages.
   How many cabbages? 93

5. 18 baskets of apples.
   23 baskets of pears.
   How many baskets of fruit? 41

6. $37 for fresh vegetables.
   $29 for fresh fruit.
   How much money for both? $66

Add.

7.	8 + 9 17	**8.**	49 + 28 77	**9.**	48 + 45 93	**10.**	8 + 3 11	**11.**	$68 + $23 $91
12.	5 + 66 71	**13.**	9 + 6 15	**14.**	19 + 76 95	**15.**	37 + 57 94	**16.**	$26 + $33 $59
17.	5 + 4 9	**18.**	45 + 24 69	**19.**	5 + 8 13	**20.**	55 + 18 73	**21.**	$7 + $6 $13

22.	37 56 93	**23.**	29 7 36	**24.**	6 8 14	**25.**	36 38 74	**26.**	8 21 29	**27.**	$46 9 $55
28.	7 2 9	**29.**	52 47 99	**30.**	36 11 47	**31.**	76 15 91	**32.**	27 25 52	**33.**	$14 58 $72

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LESSON ACTIVITY

Using the Pages

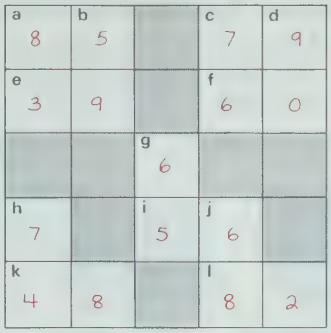
- Through discussion establish that addition is required for the six word problems in order to find the number in all.

  Give each student a five-by-five section of graph paper on which to copy and complete the number puzzle. Some students may need to be shown how to write the sums in the puzzle. Have them complete the exercises in vertical form and then record the sums in the puzzle.

Try This: In each exercise a letter replaces one of the digits 0 to 9. Thus, for Ex. 4, for example, a sum greater than 9 would require two digits and two letters would be needed. For this reason, 5 for P and 7 for E, for example, cannot be used. In Ex. 5, however, each addend as well as the sum consists of two different digits. Since more than one solution is possible it would be helpful to display the suggestions given by the students. Note that in Ex. 7, each repeated letter must be replaced by the same digit.

Copy and complete this puzzle.

Across	Down
a. 37 + 48	a. 26 + 57
c. 74 + 5	b. 40 + 19
e. 23 + 16	c. 38 + 38
f. 36 + 24	d. 22 + 68
i. 17 + 39	g. 19 + 46
k. 39 + 9	h. 59 + 15
l. 19 + 63	j. 23 + 45



Answers will vary for all of these. Examples are given.

1. Replace the letters with three different digits to make an addition fact.

$$\begin{array}{r} P\ 3 \\ E\ 4 \\ \hline A\ 7 \end{array}$$

2. Can you find other groups of three different digits that replace P, E, A and give other addition facts? 6 2 8

3. Can three of these replace P, E, A and give an addition fact? 2 4 6

yes

one-digit even numbers
0, 2, 4, 6, 8

4. Can three of these replace P, E, A and give an addition fact?

no

one-digit odd numbers
1, 3, 5, 7, 9

5. Replace the letters with six different digits to make a true addition statement.

$$\begin{array}{r} R\ A\ 12 \\ D\ I\ 35 \\ \hline S\ H\ 47 \end{array}$$

6. Can you find other groups of six different digits that replace R,A,D,I,S,H and give other true addition statements? 63 12 75

7. Replace the letters E,P,R with *three* different digits to make a true addition statement.

$$\begin{array}{r} P\ E\ 12 \\ P\ P\ 11 \\ \hline E\ R\ 23 \end{array}$$

8. Make up another problem for a friend. Use some letters more than once in the problem.

try this

37

RELATED ACTIVITIES

• Two students may practice addition with regrouping ones as tens by playing the following game.

Materials: one game board as shown, two red markers for one player, two blue markers for the other player, one die marked with the numerals 1 to 6, one die marked with the numerals 4 to 9.

tens	ones
9	9
8	8
7	7
6	6
5	5
4	4
3	3
2	2
1	1
0	0

Rules: Each player, in turn, begins by rolling the dice, adds the numbers shown, and places her/his markers on the game board to show the sum. For successive rolls of the dice, the sum computed is added to the existing score. (The students will probably need to write their examples.) The markers are moved accordingly. The winner is the first player to reach 99 or any other predetermined number.

LESSON OUTCOME

Add numbers with no regrouping and with one, two, or three regroupings, sums to 9999

Materials

models for thousands, hundreds, tens, ones, and/or a place-value pocket chart (optional)

Vocabulary

cattle, rancher, roundup

Prerequisite Skills

Demonstrate competence in lining up addends in vertical form for addition; interpret place value for numerals with up to four digits

Checking Prerequisite Skills

Show the addends in vertical form with their places lined up.

1. 73 + 19 $\begin{matrix}73\\19\end{matrix}$ **2.** 7 + 48 $\begin{matrix}7\\48\end{matrix}$

What does each digit mean in

3. 304?

3 hundreds
0 tens
4 ones

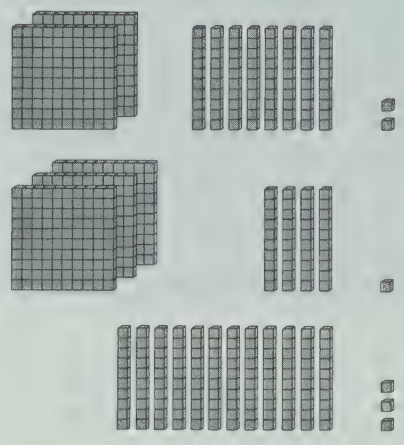
4. 5120?

5 thousands
1 hundred
2 tens
0 ones

Addition, Regrouping Ones, Tens, or Hundreds

The ranchers sold 282 cattle from one roundup and 341 cattle from another. How many cattle were sold in all?

Add 282 and 341.

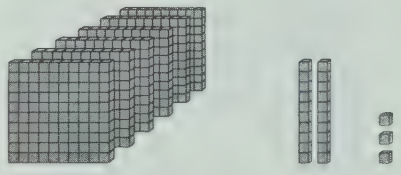


hundreds	tens	ones
2	8	2
3	4	1
	2	3

Add the ones. Then add the tens.

	1		
2	8	2	
3	4	1	
	2	3	

Regroup 12 tens as 1 hundred and 2 tens. Show the 1 hundred lined up with the other hundreds.



	1		
2	8	2	
3	4	1	
6	2	3	

Add the hundreds.

There were 623 cattle sold.

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LESSON ACTIVITY

Before Using the Pages

- Present a few examples of addition with no regrouping for sums to 9999, and have students explain the addition at the board. Some examples are as follows.

hundreds	tens	ones
4	2	5
+ 1	3	4

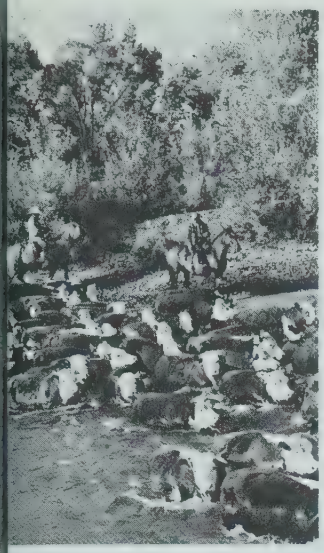
hundreds	tens	ones
2	3	8
+ 7	4	1

thousands	hundreds	tens	ones
1	6	0	2
+	1	7	3

thousands	hundreds	tens	ones
4	2	1	3
+ 1	3	5	6

- Work several regrouping exercises, similar to the followi on the board to review regrouping of tens and of hundre Emphasize that 10 tens equal 1 hundred and 10 hundr equal 1 thousand. Support the examples with models thousands, hundreds, tens, and ones as needed and/o place-value pocket chart.

thousands	hundreds	tens	ones
6	~~2~~ 3	~~17~~ 7	2
~~2~~ 3	~~15~~ 5	3	8
4	~~0~~ 1	~~10~~ 0	5



Working Together

Regroup.

1. 18 ones = 1 ten 8 ones
2. 12 tens = 1 hundred 2 tens
3. 17 hundreds = 1 thousand 7 hundreds

Regroup and complete each addition.

4. 744: 6 5 3 + 9 1 = 7 4 4
5. 4358: 2 5 4 3 + 1 8 1 5 = 4 3 5 8
6. 7996: 7 6 1 8 + 3 7 8 = 7 9 9 6
7. 5610: 4 0 0 2 + 1 6 0 8 = 5 6 1 0

Add.

8. 744 + 237 = 981
9. 1608 + 1720 = 3328
10. 943 + 4226 = 5169
11. 6081 + 358 = 6439

Exercises

Add. The sums can help you find the answer to the riddle.

A 346 + 291 = 637	C 267 + 28 = 295	D 4458 + 2270 = 6728	E 3604 + 485 = 4089	G 2639 + 2244 = 4883	H 3494 + 73 = 3567
I 1745 + 923 = 2668	L 548 + 1349 = 1897	M 1883 + 2416 = 4299	N 164 + 228 = 392	O 2506 + 307 = 2813	P 78 + 551 = 629
R 2630 + 1189 = 3819	T 945 + 642 = 1587	U 234 + 1595 = 1829	W 244 + 935 = 1179	Y 2837 + 4231 = 7068	Z 5123 + 537 = 5660

Riddle: How are cattle and the numbers 25 and 35 alike?

They are 3819 2813 1829 392 6728 4089 6728 1829 629.

Answer to the riddle: They are rounded up

39

RELATED ACTIVITIES

- Prepare cards that show four-digit numbers with more than 9 ones, 9 tens, or 9 hundreds on one side and the regrouped form for the number on the reverse side. Students can practice alone or in pairs, renaming the numbers by regrouping as needed.

th	h	t	o	8638
7	16	3	8	

- An addition wheel similar to the following can be used to generate exercises for further practice with the skills presented in this lesson.

1434
+ 3524

ing the Pages

The concept of regrouping 10 ones as 1 ten in addition is extended in the worked example to regrouping 10 tens as one more hundred. Each step of the solution is highlighted as before with red on the numerals and illustrations of models.

Briefly discuss that some farms, called ranches, specialize in raising cattle. Explain the term *roundup* if students are unfamiliar with it. As you lead the students through the solution, emphasize the steps of lining up the addends in vertical form, adding each column in turn from right to left, and regrouping 10 tens as one more hundred. Draw attention to the dotted numeral and remind the students that the numeral is thought of but not written in the sum.

orking Together: Exercises 1-3 concentrate on the skill of regrouping ones (Ex. 1), tens (Ex. 2), or hundreds (Ex. 3). This skill is applied in partially completed addition exercises (Ex. 4-7) and in exercises for which the students must think through all the necessary steps independently (Ex. 8-11). Use other similar exercises as required.

Exercises: In order to solve the riddle at the bottom of page 39, the students must first complete the sums. Each sum corresponds to one letter of the alphabet. Some of these letters will be used in decoding the riddle.

Assessment

Add.

1. 37 + 681 = 718
2. 5936 + 422 = 6358
3. 738 + 650 = 1388
4. 2159 + 4639 = 6798

Pages 40-41

LESSON OUTCOME

Add numbers with two or three regroupings, sums to 9999

Materials

models for thousands, hundreds, tens, ones, and/or a place-value pocket chart (optional)

Vocabulary

kilograms, kg

Prerequisite Skills

Add numbers with one regrouping, sums to 9999

Checking Prerequisite Skills

Add.

1. 147 + 238 = 385
2. 1253 + 462 = 1715
3. 1587 + 2911 = 4498
4. 1563 + 6245 = 7808

Addition, Two or More Regroupings

The pigs ate 2487 kg (kilograms) of feed in three months. The turkeys ate 1796 kg of feed. How much feed was eaten by the pigs and turkeys?

Add 2487 and 1796.

Add ones and regroup.

$$\begin{array}{r} {\scriptstyle 1\ \ \ \ } \\ 2487 \\ +\ 1796 \\ \hline 3 \end{array}$$

Add tens and regroup.

$$\begin{array}{r} {\scriptstyle 1\,1\ \ } \\ 2487 \\ +\ 1796 \\ \hline 83 \end{array}$$

Add hundreds and regroup.

$$\begin{array}{r} {\scriptstyle 1\,1\ \ } \\ 2487 \\ +\ 1796 \\ \hline 283 \end{array}$$

Add thousands.

$$\begin{array}{r} {\scriptstyle 1\,1\,1\ } \\ 2487 \\ +\ 1796 \\ \hline 4283 \end{array}$$

The pigs and turkeys ate 4283 kg of feed.

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Working Together

Add by following the steps.

1. 258 + 397 = 655

Add ones and regroup.
Add tens and regroup.
Add hundreds.

2. 3617 + 643 = 4260

Add ones and regroup.
Add tens.
Add hundreds and regroup.
Add thousands.

LESSON ACTIVITY

Before Using the Pages

- Work several regrouping exercises, similar to the following, on the board. Support the examples with models of thousands, hundreds, tens, and ones as needed and/or a place-value pocket chart. Be certain to regroup from right to left in the numeral. For each example, emphasize that the number represented is not changed, but the form of representing it is.

thousands	hundreds	tens	ones	
	~~4~~	~~11~~	~~13~~	
		~~12~~	3	
	5	2		523
	~~16~~	~~15~~	1	
	~~17~~	5		
1	7			1751

thousands	hundreds	tens	ones	
~~4~~	~~17~~	~~3~~	~~12~~	
5	7	4	2	574
~~6~~	~~13~~	~~9~~	~~15~~	
	~~14~~	~~10~~	5	
7	4	0		740

Using the Pages

- The worked example illustrates the steps in the right-to- procedure of adding and regrouping. The addition requi three regroupings and each step is highlighted with red the numerals and accompanied by instructions. Quest the students as you lead them through the steps. example, for the first step, ask,
"What is the sum of seven ones and six ones?"
"Since the sum is greater than nine ones what must done?"
"Where is the new ten shown?"

Exercises

Many of these are not correct. Copy each exercise that contains an error. Ring the column that has the error. Then add correctly.

Example: Incorrect

$$\begin{array}{r} 2\,4\,7\,3 \\ 1\,6\,2\,8 \\ \hline 4\,0\,0\,1 \end{array}$$

Correct

$$\begin{array}{r} 2\,4\,7\,3 \\ 1\,6\,2\,8 \\ \hline 4\,1\,0\,1 \end{array}$$

1. 305 + 2976 = 3271 3281

2. 3146 + 5978 = 8124 9124

3. 789 + 856 = 1645 correct

4. 3452 + 3877 = 7339 7329

5. 5674 + 2049 = 7713 7723

6. 476 + 6653 = 7129 correct

7. 4803 + 3907 = 8700 8710

8. 8681 + 729 = 9310 9410

9. 2254 + 1646 = 4000 3900

10. \$138 + 2462 = \$3842 \$2600

11. \$3487 + 2518 = \$6005 correct

12. \$4456 + 1199 = 5555 \$5655

Sample answers are given

1. Replace the letters with these nine different digits to make a true addition statement.

1, 2, 3, 4, 5
6, 7, 8, 9

$$\begin{array}{r} P\,I\,G \\ M\,U\,D \\ \hline J\,O\,Y \end{array}$$

283 + 176 = 459

2. Now try it using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8. 137 + 268 = 405

try this

3.

$$\begin{array}{r} 3491 \\ 4536 \\ \hline 8027 \end{array}$$

Add ones.
Add tens and regroup.
Add hundreds and regroup.
Add thousands.

4.

$$\begin{array}{r} 4853 \\ 2967 \\ \hline 7820 \end{array}$$

Add ones and regroup.
Add tens and regroup.
Add hundreds and regroup.
Add thousands.

Add.

5. 3649 + 2437 = 6086

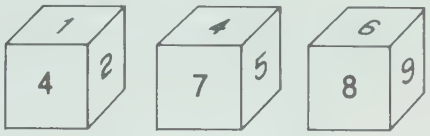
6. 350 + 678 = 1028

7. \$2619 + 589 = \$3208

41

RELATED ACTIVITIES

- Students may toss three dice to obtain random three-digit numbers. These may be used as addends in addition exercises. The first die may show 0, 1, 2, 3, 4, 5; the second die may show 2, 3, 4, 5, 6, 7; the third die may show 4, 5, 6, 7, 8, 9.



$$\begin{array}{r} 369 \\ +\ 478 \\ \hline \end{array}$$

- For practice in addition, provide work sheets having addition squares similar to the following.

+		
58	76	134
49	98	147
107	174	281

+		
275	168	443
149	499	648
424	667	1091

orking Together: To help the students recognize what regroupings are required in Ex. 1-4, steps similar to those in the worked example are provided. The students experience just two regroupings in Ex. 1-3 before three regroupings are encountered in Ex. 4. In Ex. 5-7, students must determine for themselves what regroupings are required as they add. Note that the symbol \$ should appear in the sum for Ex. 7.

ercises: Review the instructions with the students. It is often helpful to have students express in their own words what they are required to do in the exercises. For the exercises that are incorrect, most errors are related to the regrouping concept; for example, forgetting to add the "carry" numeral or adding one when no regrouping was necessary. Other possible errors involve basic fact computation and the vertical arrangement of addends. Note also that the symbol \$ should appear in the sums for Ex. 10-12.

For some exercises, for example, Ex. 9, more than one column shows an error.

Try This: The students will likely use a "guess and test" (trial and error) approach in replacing the letters with digits and finding the sums. There is more than one solution for each exercise. If the students have completed the *Try This* feature on page 37, they will be familiar with this kind of exercise, but working with three-digit numbers on this page will provide a greater challenge. Do not discuss the solutions immediately, but rather allow a few days so that some students may return to the activity as needed.

Assessment

Add.

1. 702 + 1309 = 2011

2. 2743 + 4639 = 7382

3. 4325 + 1776 = 6101

4. 3847 + 296 = 4143

Pages 42-43

OBJECTIVE

Demonstrate competence in addition with no regrouping and with one, two, or three regroupings, sums to 9999

Practice

Add.

1. 4856 + 326 = 5182	**2.** 3876 + 2594 = 6470	**3.** 994 + 2057 = 3051	**4.** 823 + 734 = 1557	**5.** \$7306 + 1997 = \$9303
6. 5083 + 2869 = 7952	**7.** 4351 + 772 = 5123	**8.** 4517 + 1556 = 6073	**9.** 7447 + 555 = 8002	**10.** \$6031 + 909 = \$6940
11. 3876 + 2943 = 6819	**12.** 952 + 297 = 1249	**13.** 2705 + 418 = 3123	**14.** 1933 + 6577 = 8510	**15.** \$4864 + 4684 = \$9548
16. 6178 + 2771 = 8949	**17.** 794 + 278 = 1072	**18.** 1695 + 4136 = 5831	**19.** 1863 + 491 = 2354	**20.** \$5410 + 3636 = \$9046
21. 398 + 4568 = 4966	**22.** 4427 + 3953 = 8380	**23.** 363 + 358 = 721	**24.** 5255 + 614 = 5869	**25.** \$3849 + 4229 = \$8078

Would you rather have

*26. \$2642 + \$577 or \$2462 + \$775? \$2462 + \$775

*27. \$4463 + \$1862 or \$3644 + \$2681? both the same

*28. \$50.25 + \$5.53 or \$52.05 + \$3.55? \$50.25 + \$5.53

*29. \$45.34 + \$16.82 or \$34.54 + \$28.16? \$34.54 + \$28.16

*30. \$17.12 + \$8.94 or \$21.71 + \$4.98? \$21.71 + \$4.98

*31. \$69.62 + \$14.75 or \$26.96 + \$57.41? both the same

Here is a way to check addition.

3876 → 3 + 8 + 7 + 6 → 24 → 2 + 4 → 6
4934 → 4 + 9 + 3 + 4 → 20 → 2 + 0 → 2
8810 → 8 + 8 + 1 + 0 → 17 → 1 + 7 → 8

If the sum of these two numbers does *not* equal this number, there is a mistake in your work.

try this

Use this method to check Exercises 16–25 on this page.

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LESSON ACTIVITY

Using the Pages

- You may wish to spread the work of these pages over several days or select only certain exercises for the students to complete. Other exercises can be left for review purposes before the *Checking Up* page at the end of the unit.

  Exercises 26-31 are starred because their solutions involve more than one step (two additions and a comparison of the two sums). Note that Ex. 28-31 will involve lining up the decimal points when the places are lined up. As a matter of interest, for the starred exercises (with the exception of Ex. 29), the order of the digits for the first pair of addends is reversed to obtain the second pair of addends. The students may notice this and discover that this does not necessarily result in a reverse order of digits for pairs of sums, as shown below for Ex. 30.

\$17.12	\$21.71
+ 8.94	+ 4.98
\$26.06	\$26.69

Students who are unfamiliar with addition squares v need a brief explanation of how to complete Ex. 32 and 3

In order to decode the message for Ex. 34, the stude must first complete the sums. Each sum corresponds to letter of the alphabet. All the letters are required for message. Note that the reversal of the letters S and E "mistakes" is intentional.

Try This: The procedure described here will provide pract with basic addition facts (and their extensions) and at same time may motivate students to check other addit exercises using this procedure. Encourage them to comp the addition of the digits mentally rather than in writin

Copy. Then add across and down to complete each addition square.

32.

368	429	797
762	558	1320
1130	987	2117

Add 368 and 429.

33.

2176	1735	3911
3849	482	4331
6025	2217	8242

Add to match each letter with a number. Then decode the message.

34.

+	666	777	888	999
1234	A	B	C	D
5678	E	F	I	K
1357	L	M	O	R
2468	S	T	U	V

D matches 1234 + 999.

			2011	6344		
2122	1900	2356	6344	6455	3356	2023
	1900	3467	2245	6566	2233	
2134	6566	3134	3245	1900	6677	3134	6344

Oops!

A 1900 B 2011 C 2122 D 2233
E 6344 F 6455 I 6566 K 6677
L 2023 M 2134 O 2245 R 2356
S 3134 T 3245 U 3356 V 3467
Be careful Avoid mistakse.

RELATED ACTIVITIES

- A store may be set up in one area of the classroom to show items or pictures of items and their prices. The students may select two items, make out a sales slip, and find the total cost.

mitt	$13.79
softball	4.95

Students could do each addition in two ways to check their answers.

276
+ 195

Standard form

11
276
+ 195
471

Simple-step form

2 7 6
+ 1 9 5
3 ~~16~~ ~~11~~
~~17~~ 1
4 7

LESSON OUTCOME

Add three numbers with regrouping, sums to 9999

Materials

number line (optional)

Prerequisite Skills

Add three one-digit numbers; add two numbers with regrouping, sums to 9999

Checking Prerequisite Skills

Add up.

1. 8, 3, 6 — 17

2. 7, 4, 9 — 20

3. 3, 7, 8 — 18

Add down.

4. 9, 9, 9 — 27

5. 2, 6, 7 — 15

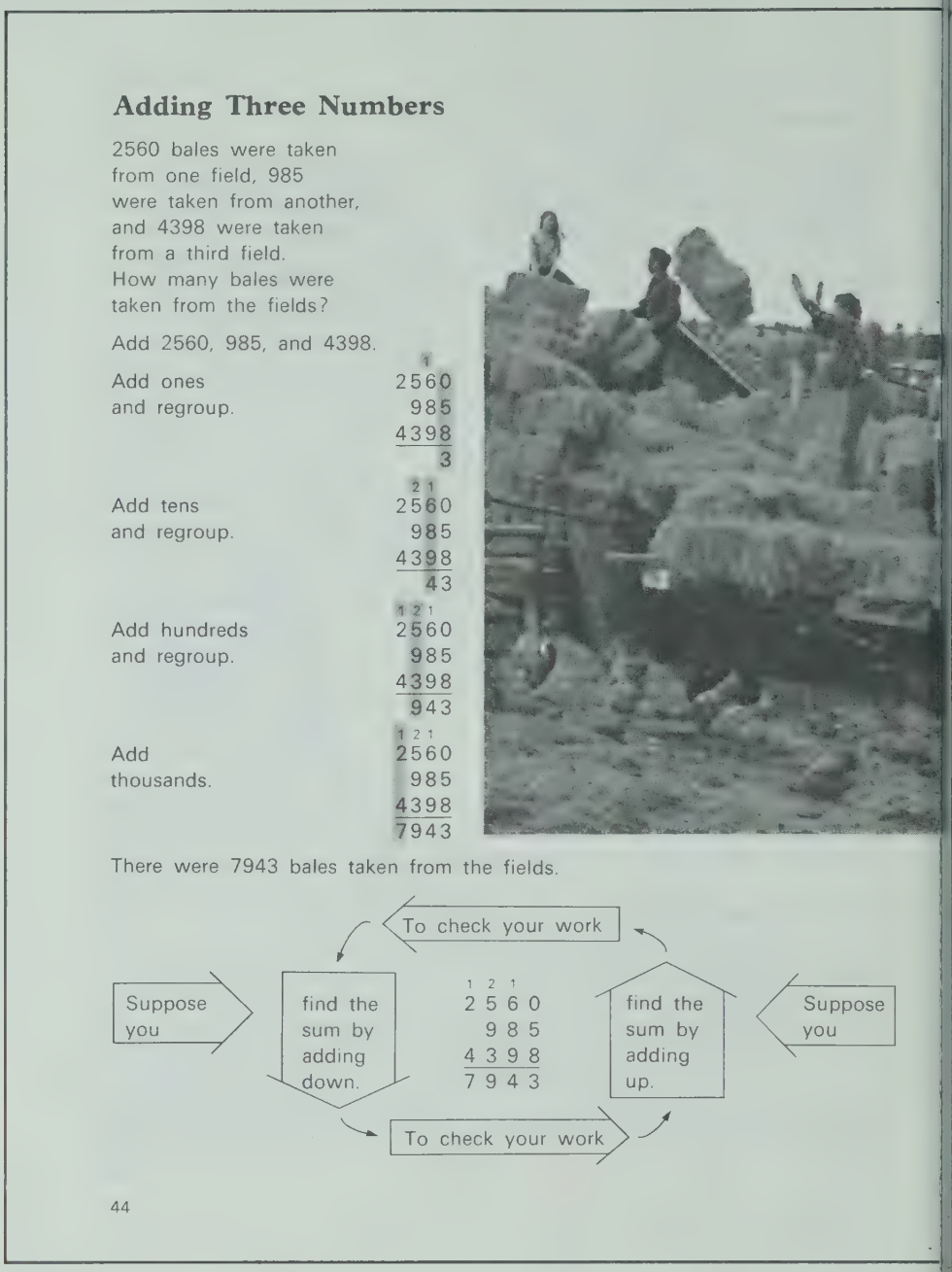
6. 7, 8, 4 — 19

Add.

7. 437 + 519 = 956

8. 1943 + 784 = 2727

9. 4075 + 3928 = 8003



Adding Three Numbers

2560 bales were taken from one field, 985 were taken from another, and 4398 were taken from a third field. How many bales were taken from the fields?

Add 2560, 985, and 4398.

Add ones and regroup.

$$\begin{array}{r} {\scriptstyle 1} \\ 2560 \\ 985 \\ 4398 \\ \hline 3 \end{array}$$

Add tens and regroup.

$$\begin{array}{r} {\scriptstyle 2\,1} \\ 2560 \\ 985 \\ 4398 \\ \hline 43 \end{array}$$

Add hundreds and regroup.

$$\begin{array}{r} {\scriptstyle 1\,2\,1} \\ 2560 \\ 985 \\ 4398 \\ \hline 943 \end{array}$$

Add thousands.

$$\begin{array}{r} {\scriptstyle 1\,2\,1} \\ 2560 \\ 985 \\ 4398 \\ \hline 7943 \end{array}$$

There were 7943 bales taken from the fields.

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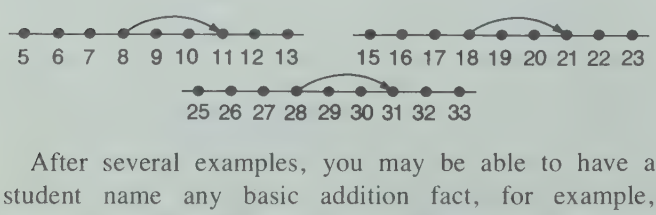
LESSON ACTIVITY

Before Using the Pages

- Have the students practice the first and second extensions of basic addition facts. Aim for a quick response to facts once the pattern has been established. Show the first few examples on the board. If necessary, illustrate the patterns on a number line.

8 + 3 = ?	9 + 7 = ?
18 + 3 = ?	19 + 7 = ?
28 + 3 = ?	29 + 7 = ?



After several examples, you may be able to have a student name any basic addition fact, for example, 2 + 5 = 7, and have each of two other students name the two extensions (12 + 5 = 17 and 22 + 5 = 27).

Using the Pages

- The worked example illustrates the steps in the right-to-l procedure of adding and regrouping in the addition of th numbers. Students who had little difficulty with addition of two numbers will readily apply the concept addition and regrouping in the addition of three numbe The procedure may take a little longer however, unl extensions of basic facts are well known.

Question the students as you lead them through the st of the solution. For example, in the first step, one of questions might be to ask why the 9 (of 985) is sho beneath the 5 (of 2560). In the second step, it will important to ask what the sum of the tens is and what m be done since there are more than 9 tens. Ask how ma "new" hundreds there are and where this is shown. In last step, ask students to consider whether the sum wo have been different if the addends had been written i different order.

To lead into the aspect of checking addition by adding the opposite direction, first ask whether the sum would

Working Together

Show the addends with their places lined up in vertical form

1. 3246 + 845 + 1056 — 3246 / 845 / 1056

2. 807 + 98 + 1343 — 807 / 98 / 1343

Add by following the steps.

3.
```
  4763
   275
6914 1876
```
Add ones and regroup.
Add tens and regroup.
Add hundreds and regroup.
Add thousands.

4.
```
  7906
   219
9942 1817
```
Add and regroup if needed.
Add and regroup if needed.
Add and regroup if needed.
Add.

Find the sum by adding down in each column.

5. 1943 / 2647 / 3552 / 8142

Find the sum by adding up in each column.

6. 1943 / 2647 / 3552 / 8142

Add. Then add in the other direction to check your work.

7. 6473 / 928 / 1345 / 8746

8. $4251 / 1984 / 683 / $6918

Exercises

Add. Then add in the other direction to check.

1. 367 / 8250 / 386 / 9003	2. 4326 / 1583 / 974 / 6883	3. 2866 / 1239 / 3673 / 7778	4. 134 / 3235 / 4678 / 8047	5. 865 / 7327 / 1403 / 9595	6. 5324 / 3049 / 888 / 9261

7. 4376 + 293 + 1406
8. 2834 + 367 + 5144
9. 286 + 3914 + 4773
10. 3086 + 2143 + 4702
11. 2309 + 1671 + 4235
12. 4300 + 299 + 1934
13. 628 + 114 + 7763
14. 121 + 4404 + 3371
15. 5368 + 205 + 3327

16. 2185 / 6495 / 485 / 9165	17. 5176 / 987 / 928 / 7091	18. 1920 / 4951 / 2934 / 9805	19. 218 / 4549 / 3326 / 8093	20. $7282 / 632 / 1026 / $8940	21. $1327 / 5329 / 1345 / $8001

7. 6075 8. 8345 9. 8973
10. 9931 11. 8215 12. 6533
13. 8505 14. 7896 15. 8900

RELATED ACTIVITIES

- Students may practice extensions of basic facts by completing tables and number wheels similar to the following. (Use copies of page T360.)

+	6
2	
12	
22	
92	

- Have students help to create addition exercises by providing the addends. One student writes a two-digit addend, another student writes a three-digit addend, and a third student writes a four-digit addend.

This activity may be conducted by students in groups of three, using three sheets of paper. After each student writes one addend on a sheet of paper, the sheets are exchanged for writing the second addend, and again for writing the third addend. Thus, each member of the group has contributed one addend to each sheet. Each student computes the sum for one sheet and draws an arrow to indicate the direction of adding (up or down). Each student checks the addition on another sheet by adding in the opposite direction. The addition on the third sheet may be checked using the method described on page 43.

different when adding down (up) rather than up (down). If some students are unsure of this, show a few examples of simple column addition on the board. Then apply that procedure for the example at the bottom of page 44. Discuss the importance of the students checking their work.

orking Together: The skill of arranging addends in vertical form correctly is important and this skill is examined in Ex. 1 and 2. It might be worthwhile to show two or three different orders for the same set of addends and have students complete the sums to show that they are equal. For Ex. 1, for example, two possibilities are given below.

3246	845
845	1056
1056	3246

Ex. 3 and 4 guide the students by naming the sequence of steps for obtaining the sum. Note, however, the phrase "if needed" in the instructions for Ex. 4. The students are thus cautioned to keep in mind that regrouping is not always necessary. In discussing the answers for Ex. 5-8, have students add aloud column by column after the exercises are shown on the board.

Exercises: Remind the students that if they perform the addition by adding up, they are to check by adding down, and vice versa. They may need to be reminded to show the symbol $ in the sums for Ex. 20 and 21.

Assessment

Add. Then add in the other direction to check.

1. 346 / 450 / 294 / 1090	2. 3209 / 4652 / 1680 / 9541	3. 2805 / 1537 / 2059 / 6401

Pages 46-47

LESSON OUTCOME

Estimate a sum by rounding each addend to the nearest ten, hundred, or thousand; solve related word problems

Materials

number line (optional)

Vocabulary

estimate

Prerequisite Skills

Add three numbers with regrouping, sums to 9999

Checking Prerequisite Skills

Add.

1.	2.	3.
478	4217	1071
326	1935	819
1590	2989	3474
2394	9141	5364

Estimating the Sum

The scales showed 341 kg, 508 kg, and 467 kg for the three cattle Helen raised. How heavy were the cattle together?

Add 341, 508, and 467.

For an easy estimate of the sum, round to the nearest hundred.

Round 341 to 300
Round 508 to 500
Round 467 to 500
Add to get 1300

For the exact sum, add in the usual way.

```
  1 1
  341
  508
+ 467
 1316
```

The cattle together were about 1300 kg.
The cattle together were exactly 1316 kg.

Working Together

Round each to the nearest hundred.

1. 724 (700)
2. 1289 (1300)
3. 450 (500)

Round each to the nearest thousand.

4. 3645 (4000)
5. 947 (1000)
6. 6500 (7000)

Round to the nearest hundred and add to estimate the sum

7. 306 + 592 + 400 (1300)
8. 1644 + 250 + 922 (2800)

Round to the nearest thousand and add to estimate the sum.

9. 1243 + 3760 + 2939 (8000)
10. 4039 + 998 + 2500 (8000)

Complete the chart.
Answers may vary

		Estimate	Exact sum
11.	291 + 476 + 1319	2100? (h)	2086 ?
12.	2444 + 875 + 3762	7100? (h)	7081 ?
13.	$1927 + $4205 + $2366	$8000? (+)	$8498 ?

When estimating a sum, round *all* the addends to either tens, or hundreds, or thousands.

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LESSON ACTIVITY

Using the Pages

- Have a student read the title at the top of page 46. Spend some time to ensure that the students understand the meaning of the word *estimate*. Explain that an estimate is a carefully considered opinion, not a haphazard guess. In this case, the estimate is obtained by rounding the addends to the nearest hundred. Discuss the importance of making reasonable estimates and suggest instances in which the skill may be applied in everyday life. For example, when purchasing items in a store, one should estimate the total cost to determine whether one has enough money to pay for them.
- The worked example illustrates that an estimate of the sum may be obtained easily if each addend is rounded to the nearest hundred. Emphasize that this procedure will give an estimate of the total mass of the cattle, and that the exact mass is found by adding in the usual way. Question the students about rounding the numbers. Ask, for example, why 341 is rounded down to 300 rather than up to 400, a why 467 is rounded up to 500 rather than down to 400. Th will provide an opportunity to review when a number rounded up and when it is rounded down. Review t agreement that was made for rounding a number that halfway between two limits. For example, 250 is halfw between 200 and 300 and, by agreement, is rounded up 300, to the nearest hundred.

Working Together: The concept of rounding numbers w introduced on pages 14 and 15 and is reviewed here in E 1-6. Use other similar exercises as required and, necessary, show parts of the number line on the board help students recall the procedure. For Ex. 7-10, th students are given the degree of accuracy for rounding th numbers. For Ex. 11-13, they must decide for themselv which place is best for rounding the numbers. Discuss th disadvantage of rounding the addends of Ex. 11 to th nearest thousand. The "thought cloud" cautions th students that each addend of an exercise must be rounded

Exercises

Round and add to estimate each sum. Then find the exact sum.

1. 385 + 232 + 456 1100(h), 1073
2. $515 + $1294 + $388 $2200(h), $2197
3. 2328 + 1926 + 1153 5000(+), 5407
4. $4481 + $1225 + $3500 $9000(+), 9206

5.	6.	7.
2347	5839	3243
881	949	1527
1152	1855	4489

8.	9.	10.
392	$4337	$765
760	2358	209
1205	1679	98

Answer each question with an estimate.

11. 912 cattle, 625 horses, and 458 pigs were entered in the judging contests. How many cattle, horses, and pigs were entered? about 2000
12. Helen sold her three cattle for $1177, $788, and $1097. How much did she get in all? about $3100
13. 1503 rodeo tickets were sold on Friday. 3498 tickets were sold on Saturday. 4079 tickets were sold on Sunday. How many tickets were sold on the three days? about 9000

*14. Three beef cattle show 489 kg, 475 kg, and 530 kg on the scales. The load limit for a truck is 1400 kg. Are the cattle too heavy for the truck? about 1500, yes

In the Prairie Provinces, ranchers use brands to keep track of their cattle. The brand of the Lazy R Ranch may look like this:

Draw a brand for each of these ranches. Answers will vary.

1. Lazy 8 Ranch ∞
2. Rocking Chair Ranch
3. Triple X Ranch XXX
4. Sliding Z Ranch Z
5. Bar N Ranch N
6. Tricky Triangle Ranch ▽
7. Running W Ranch
8. Square Knot Ranch

Name a ranch for each of these brands. Answers will vary

9. double O
10. lazy J
11. double H
12. diamond D
13. turning T
14. crazy N
15. double K
16. B bar B

17. Make up a name for a ranch and draw its brand.

try this

5. 4400(h), 4380 6. 9000(+), 8643 7. 9000(+), 9259
8. 2400(h), 2357 9. $8000(+), $8374 10. $1100(h), $1072

RELATED ACTIVITIES

• You may wish to provide students with a work sheet similar to the following.

The list shows the masses of several farm animals.

cow	544 kg
horse	725 kg
pig	90 kg
sheep	45 kg
pony	227 kg
dog	14 kg
chicken	3 kg

Estimate the answer for each question.

1. What is the mass of the three largest animals?
2. What is the mass of the three smallest animals?
3. What is the mass of three horses?
4. What is the mass of two cows and one pig?
5. What is the mass of your three favorite animals in the list?

the same place. Draw the students' attention to the fact that sometimes the estimate is less than the exact sum and sometimes it is greater than the exact sum. With practice, the estimates can be computed mentally rather than in writing.

ercises: In reviewing the instructions with the students, emphasize that exact answers are not required for Ex. 11-14, only the estimates. You may wish to help some students decide whether addends should be rounded to the nearest ten, hundred, or thousand. Ex. 14 is starred because more than one step is involved in the solution. Subtraction, however, is not needed to answer the question.

y This: These exercises are in keeping with the theme, Farming, of this unit. They can provide a refreshing change from the computation work that has been emphasized thus far. The designs the students create for Ex. 17 may be retained and referred to again in Unit 4, as illustrations of shapes that are congruent, symmetric, triangular, circular, and so on.

Assessment

Round and add to estimate each sum. Then find the exact sum.

1. 4244 + 367 + 934 (5500) 5545
2. 5364 + 1948 + 1466 (8000) 8778

Pages 48-49

OBJECTIVE

Demonstrate competence in addition without and with regrouping and in estimating the sum of three numbers, sums to 9999

Materials

an abacus for each of several small groups (optional)

Practice

Solve.

1. Andy's farm equipment used 438 L (litres) of gasoline in July, 277 L in August, and 557 L in September. How much gasoline was used during these three months? 1272 L
2. Andy sold his corn for $5360 and his beans for $3284. $8644 How much did Andy get for his corn and beans together?
3. Andy bought feed three times during the year. One time he bought 870 kg of feed. The next time he bought 1090 kg and the third time he bought 1380 kg. How much feed did he buy in all? 3340 kg
4. Andy sold three pigs. One was 96 kg, one was 109 kg, and the third was 118 kg. How heavy were the three pigs together? 323 kg

Add.

5. 1254 + 5504 + 2047 8805
6. 1780 + 3791 + 1643 7214
7. $2503 + $1434 + $659 $4596
8. 801 + 6898 + 1387 9086
9. 4299 + 918 + 1735 6952
10. $752 + $2649 + $438 $3839

11.	12.	13.	14.	15.
4404	2486	622	467	$3287
1880	2682	3983	606	4651
3493	3167	474	2760	1315
9777	8335	5079	3833	$9253
16.	**17.**	**18.**	**19.**	**20.**
6390	7235	4688	3285	$2625
2518	877	2951	190	4213
954	152	1463	6415	769
9862	8264	9102	9890	$7607

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LESSON ACTIVITY

Using the Pages

- It is important that students understand why addition is used to solve the problems in Ex. 1-4. Help them to read the problems, if necessary, and discuss the aspects of the problems that imply finding a total and thus the use of addition.

  If you wish, some of Ex. 5-20 may be left for review at a later date.

  For Ex. 21-27, have students identify the shapes shown in the diagram. Ask questions such as,
  "Which numbers are inside the triangle?"
  "Which number is inside the triangle and also inside the rectangle?"
  "Is there a number that is inside the circle and not inside any other shape?"

Try This: On page 9 of Unit 1, the *Try This* feature involv place value and regrouping as illustrated on a peg abacu Students who completed those exercises will apply th skill in finding sums using the abacus. Have the studen work in small groups to share an abacus. They may dra their pictures first and then use the abacus to check the results. No regrouping is required in Ex. 2, but regroupi is required in Ex. 4.

Find the sum of

21. the numbers inside the square. 6585

22. the numbers inside the rectangle. 7147

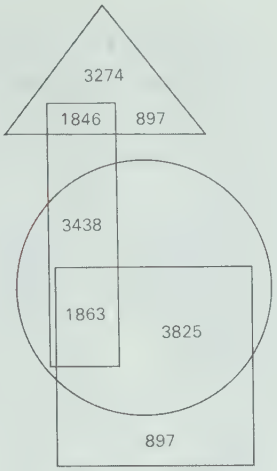
23. the numbers inside the triangle. 6017

24. the numbers inside the circle. 9126

25. the numbers inside both the circle and the square. 5688

26. the numbers inside both the circle and the rectangle. 5301

27. the numbers that are in only the triangle. 4171



Round to the nearest hundred and estimate each sum.

28. 387 + 546 + 899 1800

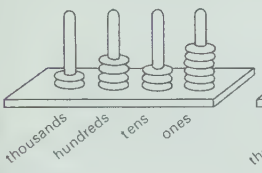
29. 589 + 476 + 229 1300

Round to the nearest thousand and estimate each sum.

30. 1544 + 2725 + 4349 9000

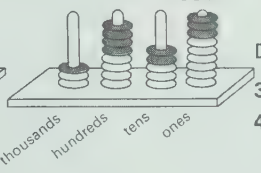
31. 3765 + 1204 + 2916 8000

An abacus can be used for adding numbers.
This abacus shows 2436.



Add 1423 to 2436.

$$\begin{array}{r} 2436 \\ 1423 \\ \hline 3859 \end{array}$$



Draw an abacus.

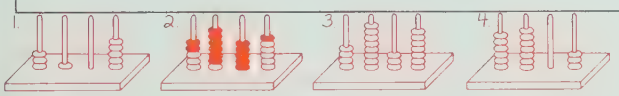
1. Show the number 3105.
2. Show the result of adding 2651 to 3105.

Draw an abacus.

3. Show the number 4837.
4. Show the result of adding 1866 to 4837.

Remember that no peg can hold more than nine rings.

try this



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RELATED ACTIVITIES

- Use the work sheet suggested in *Related Activities* on page T49. Have students find the exact sums for the questions asked.
- Have students use an abacus to find the sums for any of the earlier exercises in this unit.
- Students might use the grocery ads from newspapers and write addition exercises with three addends as suggested.

Beef	$1.59
Coffee	3.89
Butter	1.34
Total	

Tomatoes	$0.79
Ice Cream	1.65
Milk	1.43
Total	

The exercises can be written on cards with the answers on the back so that the students can check their work.

Page 50

OBJECTIVE

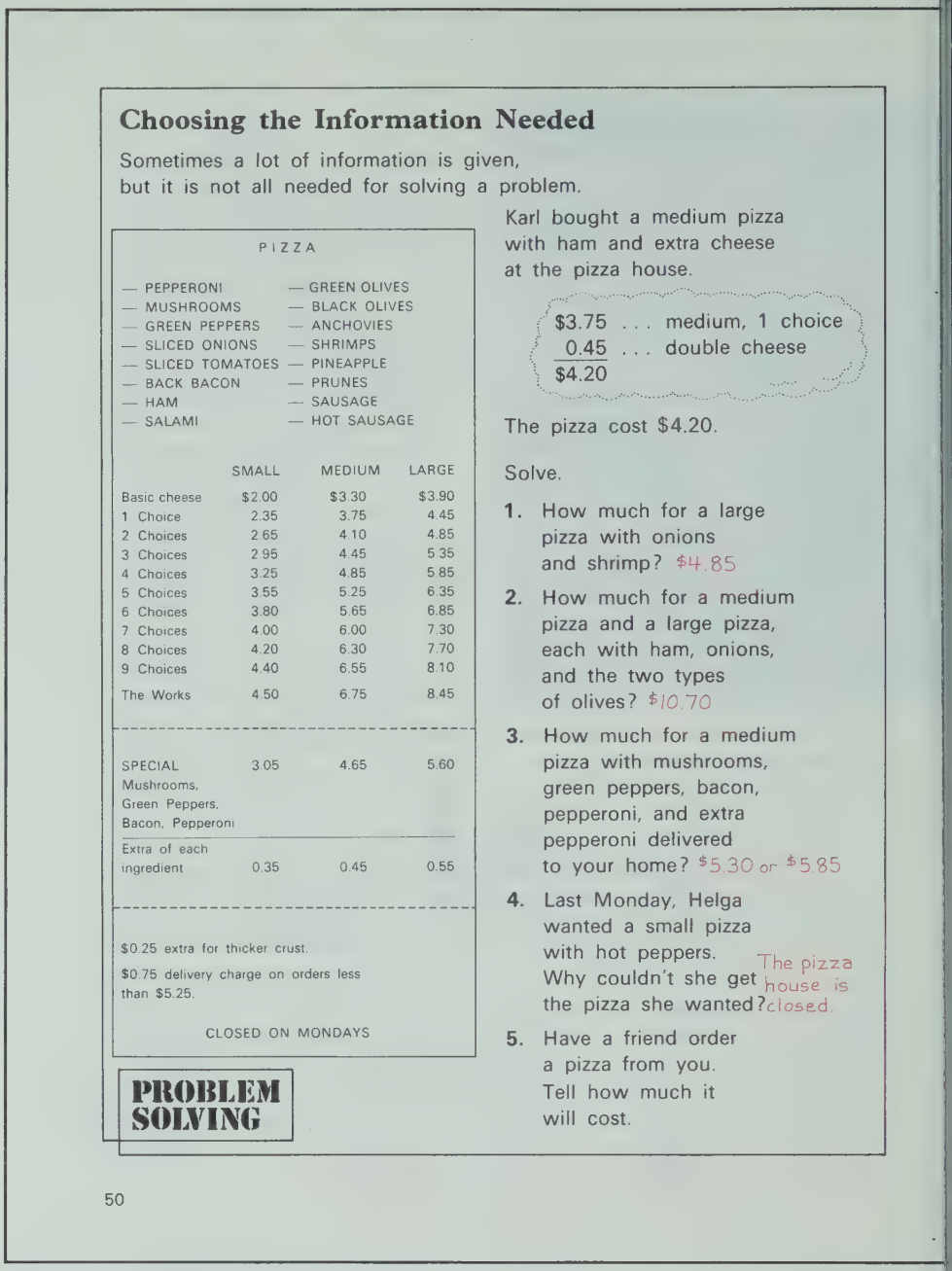
Select the necessary information for solving a problem, and then solve the problem

Materials

a sheet of paper for each student (optional)

RELATED ACTIVITIES

• Instead of a play store, a play restaurant may be set up in one area of the classroom. The restaurant may be given a name, and students may help to print the menus and write the prices for items on the menu. Students may take turns ''ordering'' and ''serving''. The order may be written up on a bill. The waiter (waitress) computes the total and the customer checks the addition.



Choosing the Information Needed

Sometimes a lot of information is given, but it is not all needed for solving a problem.

PIZZA

— PEPPERONI	— GREEN OLIVES
— MUSHROOMS	— BLACK OLIVES
— GREEN PEPPERS	— ANCHOVIES
— SLICED ONIONS	— SHRIMPS
— SLICED TOMATOES	— PINEAPPLE
— BACK BACON	— PRUNES
— HAM	— SAUSAGE
— SALAMI	— HOT SAUSAGE

	SMALL	MEDIUM	LARGE
Basic cheese	$2.00	$3.30	$3.90
1 Choice	2.35	3.75	4.45
2 Choices	2.65	4.10	4.85
3 Choices	2.95	4.45	5.35
4 Choices	3.25	4.85	5.85
5 Choices	3.55	5.25	6.35
6 Choices	3.80	5.65	6.85
7 Choices	4.00	6.00	7.30
8 Choices	4.20	6.30	7.70
9 Choices	4.40	6.55	8.10
The Works	4.50	6.75	8.45
SPECIAL Mushrooms, Green Peppers, Bacon, Pepperoni	3.05	4.65	5.60
Extra of each ingredient	0.35	0.45	0.55

$0.25 extra for thicker crust.

$0.75 delivery charge on orders less than $5.25.

CLOSED ON MONDAYS

PROBLEM SOLVING

Karl bought a medium pizza with ham and extra cheese at the pizza house.

$3.75 . . . medium, 1 choice
0.45 . . . double cheese
$4.20

The pizza cost $4.20.

Solve.

1. How much for a large pizza with onions and shrimp? $4.85
2. How much for a medium pizza and a large pizza, each with ham, onions, and the two types of olives? $10.70
3. How much for a medium pizza with mushrooms, green peppers, bacon, pepperoni, and extra pepperoni delivered to your home? $5.30 or $5.85
4. Last Monday, Helga wanted a small pizza with hot peppers. Why couldn't she get the pizza she wanted? The pizza house is closed.
5. Have a friend order a pizza from you. Tell how much it will cost.

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LESSON ACTIVITY

Using the Page

• Determine whether any of the students are familiar with ordering a pizza. Discuss their favorite pizza ingredients and suggest that sometimes it is hard to decide what to choose. Remind them that the cost of a pizza depends on such factors as the choice of ingredients and the number of ingredients.

Read the introductory statements. Give the students a few moments to study the pizza menu. Then ask them to explain how the cost of Karl's pizza is found.

Have the students show written solutions for Ex. 1-4. For Ex. 5, have each student write her/his order on a separate piece of paper and then exchange the paper with that of a classmate. If you wish, have each student cut a sheet of paper into a circular shape to represent a pizza. Have them color the shape to show the ingredients they are requesting. Ask them to write a list of the ingredients on the back of the shape. When the ''pizzas'' have been exchanged, students may show the solution for finding the cost of the pizza beside the list of ingredients.

Checking Up

Add.

1. 18 + 61 = 79	2. 423 + 124 = 547	3. 2031 + 6535 = 8566	4. 59 + 28 = 87	5. $127 + 35 = $162
6. 3548 + 1349 = 4897	7. 91 + 24 = 115	8. 243 + 585 = 828	9. 3186 + 262 = 3448	10. $326 + 811 = $1137
11. 3823 + 2546 = 6369	12. 5751 + 843 = 6594	13. 2457 + 377 = 2834	14. 74 + 49 = 123	15. $159 + 196 = $355
16. 857 + 713 = 1570	17. 4903 + 2907 = 7810	18. 4619 + 574 = 5193	19. 2657 + 3352 = 6009	20. $6264 + 872 = $7136
21. 483 + 583 = 1066	22. 7146 + 1978 = 9124	23. 5856 + 2366 = 8222	24. 968 + 794 = 1762	25. $3579 + 4865 = $8444
26. 2947 + 1643 + 5234 = 9824	27. 5464 + 839 + 2645 = 8948	28. 489 + 1623 + 379 = 2491	29. 3351 + 2975 + 783 = 7109	30. $4608 + 3089 + 1753 = $9450

Choose the better estimate for each sum.

31. 755 + 1066 + 443 (2300)

2200 or 2300

32. 2316 + 1548 + 1299 (5000)

4000 or 5000

33. $1172 + $485 + $626 ($2300)

$2100 or $2300

Solve.

34. A farmer sold the apple crop for $3685 and the pear crop for $2490. How much did the two crops sell for? $6175

35. The tractor is 3188 kg. The loaded wagon is 2876 kg. How heavy are the tractor and the wagon together? 6064 kg

36. Betty picked 879 boxes of raspberries, Henry picked 608, and Jill picked 1170. How many boxes did they pick in all? 2657

37. On Thursday 1240 tickets were sold at the fair. 3929 were sold on Friday and 4087 on Saturday. How many were sold in all? 9256

38. The car raffle earned $3076. The boat raffle earned $1927. How much did the raffles earn? $5003

39. The pens held 47 sheep, 136 cows, and 39 pigs. How many animals were in the pens? 222

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Page 51

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Provide students with road maps and have them refer to the distance charts on the maps to plan short trips and find the total distance they would travel.
- For students who require more practice with regrouping in addition, it is helpful to use a learning device not encountered in the teaching lessons, for example, a flannel board and several felt numerals for 0 to 9. The place-value headings for four-digit numerals are shown on the flannel board and students use felt numerals to show the addends and the sum. For the example below, a student uses the felt numerals 1 and 3 to show 13 ones for the sum. To regroup, the student moves the felt numeral 1 from the ones' column to the top of the tens' column. A similar procedure is used to add and regroup in the remaining columns.

thousands	hundreds	tens	ones
	1	1	
2	3	6	8
+ 1	4	7	5
		4	3

Skills	Exercises	Related Pages
Add, no regrouping	1	T36-T37
	2, 3	T40-T41
Add, regrouping ones as tens	4	T36-T37
	5, 6	T40-T41
Add, regrouping tens as hundreds	7-9	T40-T41
Add, regrouping hundreds as thousands	10-12	T40-T41
Add, two regroupings	13-21	T42-T43
Add, three regroupings	22-25	T42-T43
Add three numbers, up to three regroupings	26-30	T46-T47
Round addends and add to estimate a sum	31-33	T48-T49
Solve addition problems	34-39	

Comments

The chart showing the skills required for the exercises on this page facilitates locating an area of difficulty. Usually students who answer correctly almost all the exercises for a skill have mastered that skill. Students should review a skill for which they answer only half of the exercises correctly. If students answer less than half of them correctly, that skill should be retaught.

Some students have a tendency to regroup for each exercise without considering whether regrouping is necessary. Emphasize that regrouping in addition is required only to avoid writing a number greater than nine in a column. Use of the flannel board with felt numerals (described in *Related Activities*) is helpful in developing this concept.

Unit 3 Overview

Subtraction

The first part of this unit reviews the basic subtraction facts and the subtraction algorithm with regrouping in two-digit minuends. This skill is then extended to four-digit minuends with one regrouping, and eventually to minuends requiring more than one regrouping. A separate lesson is devoted to regrouping in subtraction when there are zeros in the minuend. The inverse relationship between addition and subtraction is used to present one method of checking for accuracy in subtraction. The use of parentheses in number sentences which include both addition and subtraction is introduced. The last lesson deals with word problems whose solutions require two or more steps.

Prerequisite Skills

- interpret place value for numerals with up to four digits
- add with regrouping, sums to 9999
- write numerals for amounts of money using the symbol $

Unit Outcomes

- complete the basic subtraction facts and patterns in subtraction
- subtract numbers with and without regrouping, minuends to 9999
- subtract with regrouping for zero tens and/or zero hundreds, minuends to 9999
- use addition to check subtraction
- solve word problems involving addition and subtraction
- simplify a number phrase with three terms involving addition and/or subtraction by first completing the operation shown within parentheses
- solve problems involving two or more steps

Background

The major thrust of this unit is directed toward a meaningful approach to regrouping in the minuend. This particular skill presents considerable difficulty to many students, probably because it requires careful analysis of both the minuend and the subtrahend. This itself is a complex task. First, the two numbers must be compared to determine which is the greater, and, therefore, considered the minuend. Then, after writing the numbers in a vertical arrangement, each pair of digits in successive places from right to left must be examined to see if the one in the minuend is greater. If it is, the subtraction in that place can proceed directly; but if it is not greater, regrouping from the next higher place value on the left is required. A sequence of 13 steps is outlined in the example shown.

Subtract 1885 from 3543.

1. 3543 is greater than 1885.

2. Show the vertical form.

$$\begin{array}{r} 3\ 5\ 4\ 3 \\ -\ 1\ 8\ 8\ 5 \\ \hline \end{array}$$

3. The ones' place shows 3 − 5.

4. Regroup 4 tens 3 ones
as 3 tens 13 ones.

5. Subtract the ones.

$$\begin{array}{r} \ 3\ 13 \\ 3\ 5\ \not{4}\ \not{3} \\ -\ 1\ 8\ 8\ 5 \\ \hline \ 8 \end{array}$$

6. The tens' place shows 3 − 8.

7. Regroup 5 hundreds 3 tens
as 4 hundreds 13 tens.

8. Subtract the tens.

$$\begin{array}{r} \ 13 \\ \ 4\ \not{3}\ 13 \\ 3\ \not{5}\ \not{4}\ \not{3} \\ -\ 1\ 8\ 8\ 5 \\ \hline \ 5\ 8 \end{array}$$

9. The hundreds' place shows 4 − 8.

10. Regroup 3 thousands 4 hundreds
as 2 thousands 14 hundreds.

11. Subtract the hundreds.

$$\begin{array}{r} \ 14\ 13 \\ 2\ \not{4}\ \not{3}\ 13 \\ \not{3}\ \not{5}\ \not{4}\ \not{3} \\ -\ 1\ 8\ 8\ 5 \\ \hline \ 6\ 5\ 8 \end{array}$$

12. The thousands' place shows 2 − 1.

13. Subtract the thousands.

$$\begin{array}{r} \ 14\ 13 \\ 2\ \not{4}\ \not{3}\ 13 \\ \not{3}\ \not{5}\ \not{4}\ \not{3} \\ -\ 1\ 8\ 8\ 5 \\ \hline 1\ 6\ 5\ 8 \end{array}$$

The extra steps involved cause many students to dislik subtraction and to have frequent errors. It is, therefore, mo important that the operation of subtraction be treated with gre emphasis on meaningful understanding of the steps.

Zeros in the minuend require special consideration. Th approach recommended in this text suggests that a number regroupings be compressed into a single step. To achieve thi the minuend is examined in terms of several places. Fo example,

3000 is 3 thousands, or
30 hundreds, or
300 tens.

In A below, since regrouping tens is needed so that 5 ones ca be subtracted, the minuend may be interpreted as 300 tens 0 one and then regrouped as 299 tens 10 ones in a single step. Th subtraction then proceeds without further regrouping. Note ho much more complex is the method shown in B which require several regrouping steps.

A

$$\begin{array}{r} \ 299\ \ 10 \\ \not{3}\ \not{0}\ \not{0}\ \not{0} \\ -\ 2\ 8\ 9\ 5 \\ \hline 1\ 0\ 5 \end{array}$$

B

$$\begin{array}{r} \ 9\ \ 9 \\ 2\ \not{10}\ \not{10}\ 10 \\ \not{3}\ \not{0}\ \not{0}\ \not{0} \\ -\ 2\ 8\ 9\ 5 \\ \hline 1\ 0\ 5 \end{array}$$

Using addition to check for accuracy in subtraction i dependent on the inverse relationship between the two opera tions. What one operation "does", the other "undoes". Th

ect of adding 8, for example, is "undone" by subtracting 8. milarly, the effect of subtracting 5 is "undone" by adding 5.

$$7 + 8 = 15 \longleftrightarrow 15 - 8 = 7$$
$$14 - 5 = 9 \longleftrightarrow 9 + 5 = 14$$

is relationship can be extended to much larger numbers to eck that the differences in subtraction are correct.

The procedure of checking by addition is often shown in itten form as in the example above. However, most students d that the procedure can be carried out more quickly simply adding upward in the completed subtraction algorithm. If the m of the difference and the subtrahend matches the minuend, subtraction is correct.

All operations with numbers are *binary* in nature; that is, only o numbers can be combined at one time to produce a new mber. If an expression involves three or more numbers, its ue is determined in stages using two numbers at a time. When re than one operation is indicated, parentheses are frequently ed to group symbols so that the number represented can be arly identified. For instance, in C, the number phrase + 26 names the number 69, and the value of the entire pression is 3.

C
$$72 - (43 + 26)$$
$$= 72 - 69$$
$$= 3$$

When parentheses are not used there is an agreement, or nvention, among mathematicians concerning the order of cedure. Briefly, multiplication and division are performed st in the order of occurrence from left to right. Then, addition d subtraction are performed from left to right as they occur. is is illustrated in the following examples.

$$9 + 4 \times 7$$
$$= 9 + 28$$
$$= 37$$

$$45 \div 9 \times 4$$
$$= 5 \times 4$$
$$= 20$$

$$40 + 6 \div 3 - 7 \times 5$$
$$= 40 + 2 - 35$$
$$= 42 - 35$$
$$= 7$$

Although much of this background is beyond the domain of thematical thinking for students at this level, it is quite vious that parentheses serve a useful function in clarifying aning. Returning to C, if parentheses are not used, the value the expression is quite different from the previous value, 3:

$$72 - 43 + 26$$
$$= 29 + 26$$
$$= 55$$

The work with expressions and number sentences in which eral numbers and more than one operation are involved leads ectly into solving problems in two or more steps. This is the ticular problem-solving skill developed in Unit 3. The mple on page 72 shows separate algorithms and most dents will tend to use this method. More capable learners may be challenged to structure the numbers and the sequence of steps in an expression or a number sentence. For the example on page 72, the expression would be 495 + 347 − 516, and this would be simplified in two steps from left to right.

Teaching Strategies

Mastery of basic subtraction facts is equally important as the mastery of basic addition facts. Timed or dictated tests of the subtraction facts are strongly recommended prior to beginning the work of the unit. Individual errors should be specifically identified and followed by practice and drill. Several suggestions are offered in the *Related Activities* suggested for the first two lessons of this unit. It is also a good policy to have students write and/or say all the related subtraction and addition facts so that their recall may be strengthened. For example, if a student has difficulty remembering 16 − 9 = 7, he/she should practice four facts:

$$16 - 9 = 7 \qquad 7 + 9 = 16$$
$$16 - 7 = 9 \qquad 9 + 7 = 16$$

Since much of the work in the unit deals with regrouping, students should use models, peg abaci, and place-value pocket charts to demonstrate their understanding of the regroupings which occur. While some students do the work on paper, others may, at the same time, show the algorithms on the chalkboard, and still others may manipulate models and devices.

Before the lesson on pages 64 and 65 (regrouping with zeros in the minuend), the students would probably benefit from interpreting four-place numerals without zeros in several ways. For example, 4216 may be interpreted in the following four ways.

thousands	hundreds	tens	ones
4	2	1	6
	42	1	6
		421	6
			4216

This preliminary step of renaming numbers would help to remove some of the uniqueness attached to renaming numbers with several zeros.

The chart on page T 77 may be used to diagnose strengths and weaknesses in the several subtraction skills in the unit. Follow-up reteaching, review, and practice should be planned to overcome any deficiencies which are detected.

Materials

models for thousands, hundreds, tens, and ones
place-value pocket chart, several abaci

Vocabulary

subtract
subtraction
minus
difference
minutes, min
parentheses
Magic Square
diagonally
machine
department store
baseball field

LESSON OUTCOME

Complete the basic subtraction facts; complete subtraction patterns

Vocabulary

subtract, minus, –, subtraction machine

3 SUBTRACTION

Basic Facts

Ivy had 15 pictures. She gave away 9 of them. How many does she have left?

Subtract 9 from 15.

$$\begin{array}{r} 15 \\ -\ 9 \\ \hline 6 \end{array}$$

$15 - 9 = 6$

Ivy has 6 pictures left.

Exercises

Subtract.

1. 13 – 6 7	**2.** 8 – 4 4	**3.** 12 – 7 5	**4.** 16 – 7 9	**5.** 11 – 3 8
6. 11 – 8 3	**7.** 15 – 7 8	**8.** 10 – 3 7	**9.** 10 – 8 2	**10.** 14 – 6 8
11. 9 – 3 6	**12.** 13 – 5 8	**13.** 8 – 3 5	**14.** 17 – 9 8	**15.** 12 – 6 6
16. 11 – 2 9	**17.** 11 – 7 4	**18.** 15 – 6 9	**19.** 11 – 5 6	**20.** 15 – 8 7

21. 10 − 2 = 8	**22.** 13 − 4 = 9	**23.** 17 − 8 = 9	**24.** 12 − 5 = 7	**25.** 14 − 5 = 9	**26.** 8 − 6 = 2
27. 13 − 9 = 4	**28.** 7 − 3 = 4	**29.** 11 − 6 = 5	**30.** 10 − 1 = 9	**31.** 10 − 6 = 4	**32.** 13 − 7 = 6
33. 12 − 9 = 3	**34.** 14 − 8 = 6	**35.** 18 − 9 = 9	**36.** 13 − 8 = 5	**37.** 11 − 9 = 2	**38.** 12 − 4 = 8

52

LESSON ACTIVITY

Using the Pages

- Some students may be familiar with the procedure of having their photographs taken in a booth. Encourage them to share these experiences. Discuss that students often enjoy exchanging photographs of themselves with friends.

  Discuss the worked example, emphasizing that the answer to "How many does she have left?" is found by subtraction because the operation is related to "taking away". The students may, if necessary, cover nine of the pictures to check that there are six pictures left. Point out the horizontal form and the vertical form for subtraction.

  Change the numbers of the word problem to create a new word problem for a similar situation. Repeat this several times, having students help to create the new problems. Have other students write corresponding subtractions (horizontal or vertical forms) on the board and adapt the concluding statement for each new problem.

  You may wish to discuss that the problem is not solv by the subtraction 9 – 15 because subtraction is n commutative.

Exercises: The emphasis for these exercises should be accura with speed. The minus signs are not shown in the verti form since the instruction "Subtract" is provided for ea set of exercises. If necessary, explain how the subtracti chains are completed for Ex. 39-42 and how the tables f the subtraction machines in Ex. 43-45 are completed. No that Ex. 45 and 46 review the role of zero as a subtrahe and as a difference, respectively. Ex. 47-49 will challen some students. A discussion of how various stude arrived at their answers will be beneficial. For example, f Ex. 47, some students may subtract 4 from 12 and then a 1 to the difference (since the fourth picture has not yet be taken). Other students may first subtract 1 from 4 to expla that only 3 pictures have been taken, and then subtract from 12. Still other students may start at 4 and count on 12.

Complete each subtraction chain.

39. 13 → 4 → 4 → 4 → 1 (9→9, 5→5)

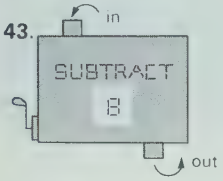
40. 10 → 4 → 3 → 2 → 1 → 0 (6→6, 3→3, 1→1)

41. 11 → 5 → 1 → 3 (6→6, 5→5, 2)

42. 16 → 8 → 2 → 5 → 0 (8→8, 6→6, 1→1, 1)

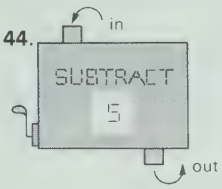
Copy and complete the table for each subtraction machine.

43.



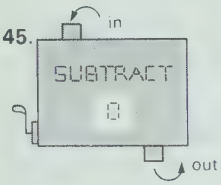
in	15	10	13	14	8	12
out	7	2	5	6	0	4

44.



in	10	12	8	6	11	7
out	5	7	3	1	6	2

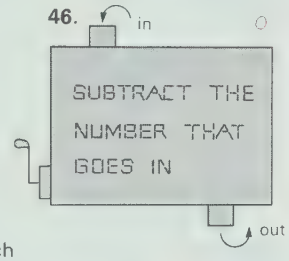
45.



in	3	8	5
out	3	8	5

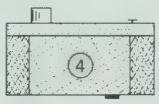
What number would always come out of this machine?

46.



The window in the back of a camera shows which picture on the film will be taken next. The films in these cameras have 12 pictures each. How many pictures are left to be taken on each?

***47.**

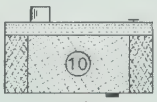


9

***48.**

4

***49.**



3

RELATED ACTIVITIES

- Provide opportunities for students to improve their speed and accuracy in completing basic subtraction facts in a manner similar to those suggested for addition in *Related Activities* on page T35.
- A variation of the subtraction machine may be used with small groups of students to practice related addition and subtraction facts. A simple machine could be prepared from a cardboard carton and decorated as desired. A window can display a numeral card to show what number is being subtracted. Numeral cards, one for each of 0 to 9, are placed in the box. A student draws a card to represent the difference and then tells what number must be put into the machine so that, if 6 is subtracted, that difference will result. For example, if 8 is chosen as the difference, the required input number can be found by addition (8 + 6 = 14), and the related subtraction fact can be named (14 − 6 = 8).
- Two students may play "Subtraction Snap". Each player needs a set of numeral cards for the numbers 0 to 18. Players shuffle their cards and place them in a stack face down. Each player exposes the top card. The player whose card shows the greater number must name the difference of the two numbers. Play continues until all the cards have been exposed.

sessment

btract.

12 − 9 3	**2.** 13 − 6 7	**3.** 10 − 7 3
11 − 3 8	**5.** 13 − 5 8	**6.** 17 − 8 9

18	**8.** 15	**9.** 9	**10.** 14
9	7	7	5
9	8	2	9

LESSON OUTCOME

Subtract numbers with no regrouping and with regrouping tens as ones, minuends to 99; solve related word problems

Materials

models for tens and ones and/or a place-value pocket chart (optional)

Vocabulary

difference

Prerequisite Skills

Complete the basic subtraction facts; interpret place value for two-digit numerals

Checking Prerequisite Skills

Subtract.

1. 14 − 5 = 9	**2.** 17 − 8 = 9	**3.** 9 − 2 = 7
4. 11 − 7 = 4	**5.** 13 − 8 = 5	**6.** 16 − 9 = 7

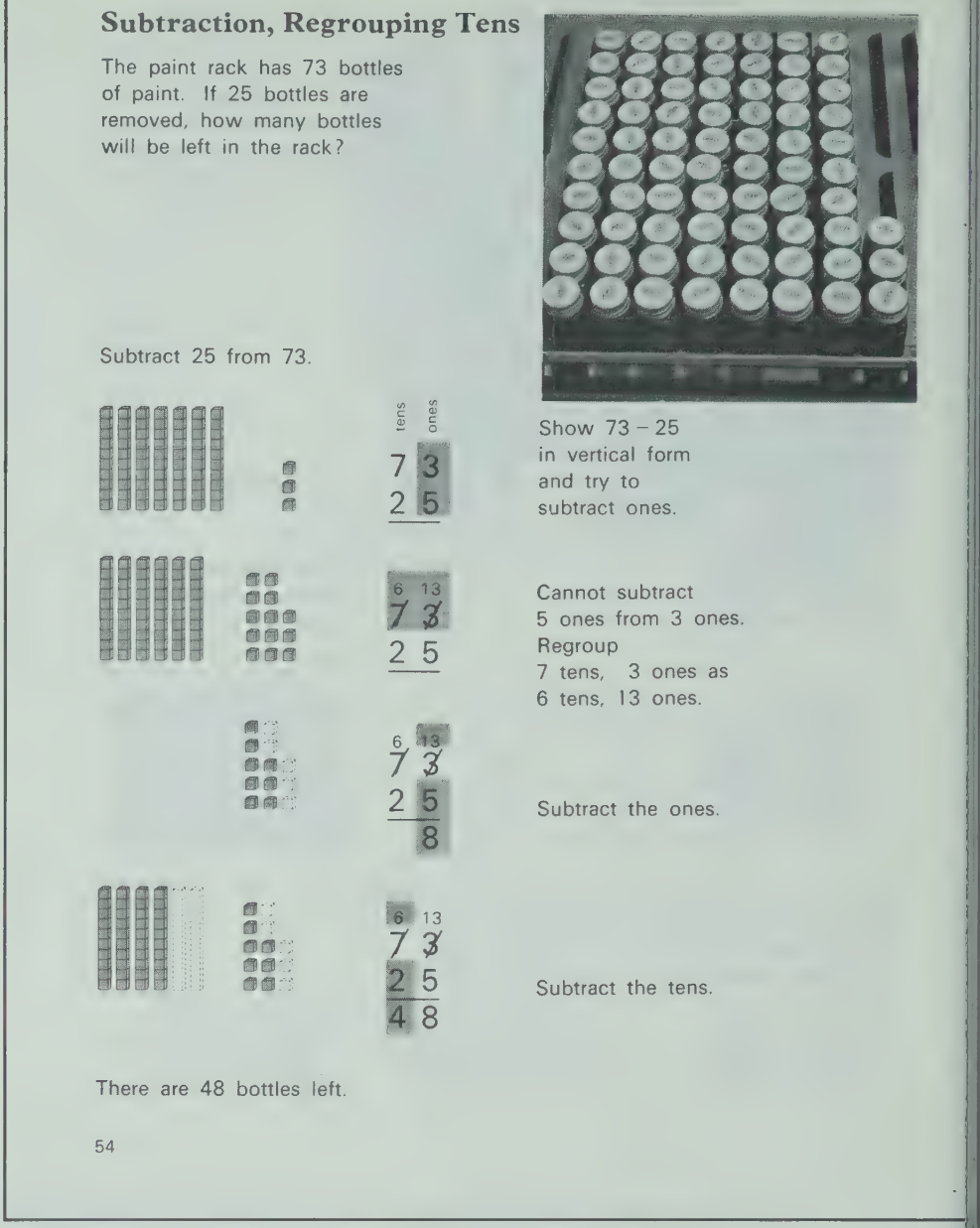
Complete.

7. 28 = 2 tens 8 ones

8. 90 = 9 tens 0 ones

9. 75 = 7 tens 5 ones

10. 43 = 4 tens 3 ones



Subtraction, Regrouping Tens

The paint rack has 73 bottles of paint. If 25 bottles are removed, how many bottles will be left in the rack?

Subtract 25 from 73.

tens ones

7 3
2 5

Show 73 − 25 in vertical form and try to subtract ones.

6 13
7 3
2 5

Cannot subtract 5 ones from 3 ones. Regroup 7 tens, 3 ones as 6 tens, 13 ones.

6 13
7 3
2 5
8

Subtract the ones.

6 13
7 3
2 5
4 8

Subtract the tens.

There are 48 bottles left.

54

LESSON ACTIVITY

Before Using the Pages

- Present a few examples of subtraction with no regrouping for minuends to 99, and have students explain the subtraction.

85	47	69
− 23	− 13	− 44

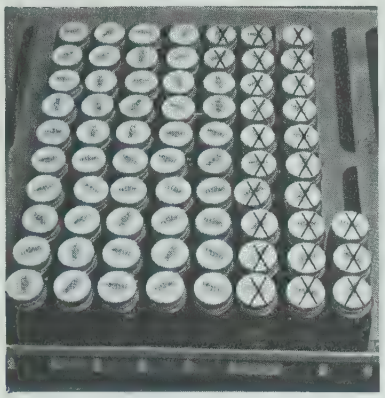
- Work several regrouping exercises, similar to the following, on the board to review regrouping 1 ten as 10 more ones. Support the examples using models of tens and ones and/or a place-value pocket chart as needed. Emphasize that the two forms name the same number for each exercise because 1 ten equals 10 ones.

	tens	ones
32	~~3~~	~~2~~
	2	12
50	~~5~~	~~0~~
	4	10

Using the Pages

- The worked example illustrates the procedure of regrouping ten as 10 more ones to facilitate subtraction. The steps a highlighted by red on the numerals, a description of ea step, and the illustrations of models of tens and ones.

  Read the first sentence of the problem. Have the studer note in the photograph on page 54 that there are 7 colum of paint bottles with 10 bottles in each column and column of 3 bottles. Summarize that 7 tens and 3 ones a 73. Read the second sentence of the problem and devel that subtraction is required to solve the problem since wish to find how many will be left after some bottles a removed. In leading the students through the steps, poi out the words "and try to subtract ones". Have studer explain the implication in the word *try* and relate this to t need to regroup 1 ten as 10 more ones. Have them note t method for showing the regrouping in the exercise. Ha the students explain how the photograph on page illustrates the removal of 25 bottles and the difference 48



Working Together

Regroup to show 10 more ones.

	tens	ones
Example:	3	16

	tens	ones
1.	2	17
2.	7	14

Subtract by following the steps.

3. 45 ← Regroup to show 10 more ones.
   26
   19
   ↑ Subtract ones.
   ↑ Subtract tens.

Subtract.

4. 97 − 61 = 36
5. 83 − 46 = 37
6. 40 − 16 = 24

Exercises

Find the difference of

1. 62 and 25. 37
2. 19 and 78. 59
3. 76 and 44. 32
4. 64 and 46. 18
5. 28 and 47. 19
6. 18 and 78. 60

Subtract.

7.	80 − 28 = 52	8.	78 − 35 = 43	9.	43 − 5 = 38
10.	60 − 19 = 41	11.	57 − 29 = 28	12.	97 − 23 = 74
13.	52 − 7 = 45	14.	77 − 57 = 20	15.	74 − 68 = 6
16.	68 − 26 = 42	17.	56 − 18 = 38	18.	85 − 36 = 49
19.	94 − 45 = 49	20.	94 − 63 = 31	21.	60 − 33 = 27

Solve.

22. Bill has 94¢. He buys a model airplane for 75¢. How much money does Bill have left? 19¢
23. The hobby shop sold 33 model cars and 14 model airplanes. How many more model cars than airplanes did it sell? 19
24. 73 models are in the show. 27 of them are airplanes. How many other models are there? 46
25. There are 50 models in one model car set. Rose has 33 of them. How many more models does she need to complete the set? 17

RELATED ACTIVITIES

- Some students may be interested in exploring subtraction by compensation. To subtract a number that is not a multiple of ten, the minuend and the subtrahend are equally "compensated" or adjusted by addition or subtraction to obtain a multiple of ten as the subtrahend. For example, by adding 2 to each number,

  47 − 38 becomes 49 − 40

  and by subtracting 3 from each number,

  62 − 23 becomes 59 − 20

  Demonstrate a few examples and have students suggest why this method works. You may wish to have them use this method to check their answers for exercises completed earlier.
- Small groups of students may practice basic subtraction facts by playing the game "Subtraction Relatives" as described on page T 345.

rking Together: To subtract with regrouping, students must first be secure with the skill of regrouping 1 ten as 10 more ones. This skill is dealt with in Ex. 1 and 2. Use other similar exercises as needed. The steps to complete the subtraction are described for Ex. 3. Have the students follow similar steps for completing Ex. 4-6. Note that Ex. 4 does not require regrouping.

ercises: Point out the word *difference* in the first directive. Review that the result in addition is called the *sum* and the result in subtraction is called the *difference*. Remind the students that Ex. 1-6 should be written in vertical form with the greater number above the lesser number.

sessment

btract.

1. 43 − 13 = 30
2. 62 − 47 = 15
3. 90 − 24 = 66
4. 35 − 18 = 17

Pages 56-57

OBJECTIVE

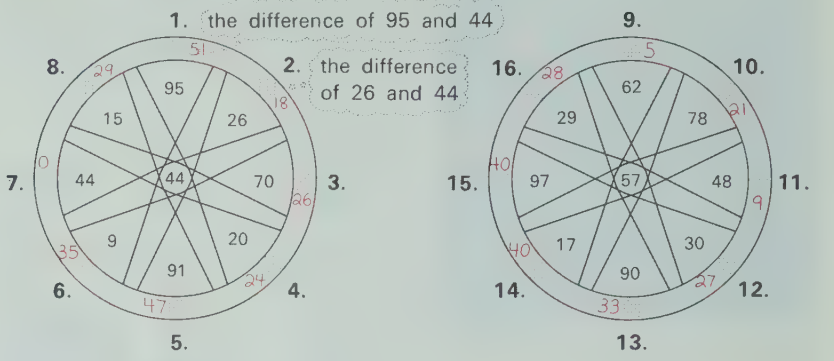
Demonstrate competence in subtraction with no regrouping and with regrouping tens as ones, minuends to 99; solve related word problems

Vocabulary

minutes, min

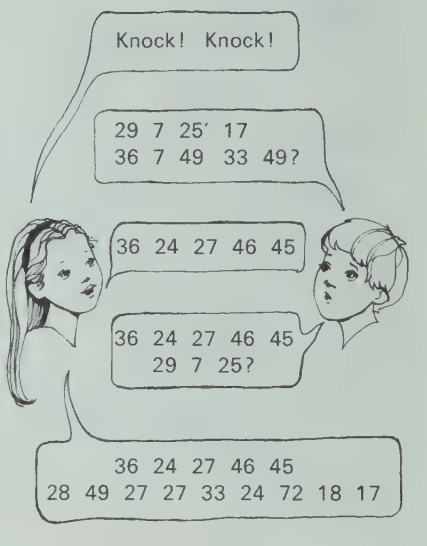
Practice

Write the differences that complete each wheel.



Subtract. The differences will help you solve the Knock! Knock! joke.

A 78 − 33 = 45	B 47 − 19 = 28	C 81 − 15 = 66
D 83 − 37 = 46	E 74 − 25 = 49	G 56 − 38 = 18
H 36 − 29 = 7	I 52 − 28 = 24	L 45 − 18 = 27
N 96 − 24 = 72	O 33 − 8 = 25	R 69 − 36 = 33
S 34 − 17 = 17	T 65 − 29 = 36	W 85 − 56 = 29



Who's there? Tilda Tilda who? Tilda Bellrings

56

LESSON ACTIVITY

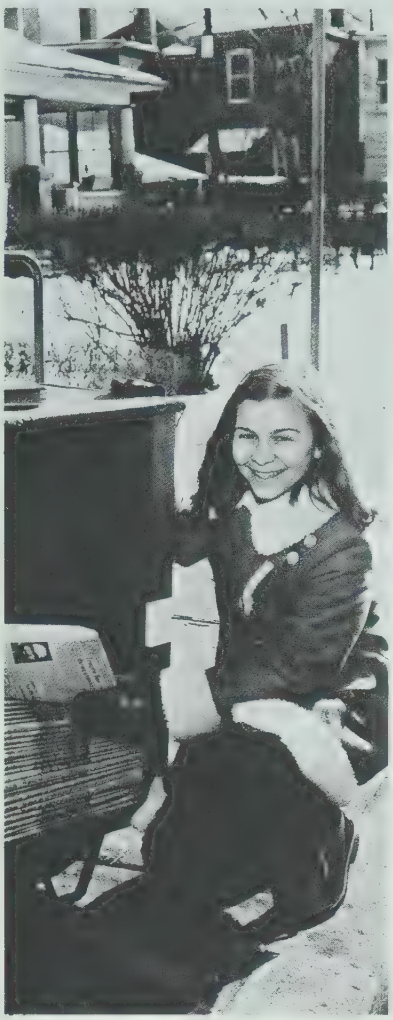
Using the Pages

- You may wish to begin with a brief discussion of the photograph on page 57. Perhaps there are students in your class who have paper routes. They may enjoy sharing some of their experiences with the rest of the class. You may wish to have them tell how many papers they deliver each day and about how long it takes to deliver them.
- Remind the students that the subtractions are written in vertical form for the number wheels, and that the greater number is the minuend.

  If necessary, explain how the differences for the exercises coded with letters will help solve the Knock! Knock! joke.

  Ex. 10 on page 57 is starred because it requires more than one step to solve the problem. Also, there are two possibilities to consider: if Rita walks and Jerry rides; if Jerry walks and Rita rides.

Rita delivers 80 newspapers and Jerry delivers 73 after school on their paper routes.



Solve.

1. How many more papers does Rita deliver than Jerry? 7
2. Rita had delivered 55 of her papers when she stopped to rest. How many did she have left to deliver? 25
3. Jerry had delivered 44 when he stopped to rest. How many did he have left to deliver? 29
4. By the time she reaches Maple Lane, Rita has delivered 62 papers. How many does she have left? 18
5. One week Rita collected $82 on her route. Her bill was $64. How much did she make that week? $18

Sometimes Rita and Jerry use their bicycles.

	Bicycle	Walking
Rita	42 min	73 min
Jerry	29 min	55 min

6. How much more time does Jerry take walking instead of riding? 26 min
7. How much less time does Rita need to deliver papers when she uses her bicycle? 31 min
8. How much more time than Jerry does Rita take when both walk? 18 min
9. How much less time than Rita does Jerry take when both ride? 13 min
*10. Who finishes sooner when one walks and the other rides? How much sooner?
10 When Rita walks and Jerry rides, Jerry finishes sooner by 44 min. When Jerry walks and Rita rides, Rita finishes sooner by 13 min.

RELATED ACTIVITIES

• Students who have (or have had) paper routes may show information similar to the following on cards. The cards may be used to generate word problems, similar to those on the page, for the students to solve.

Jim 60 papers
50 min walking
35 min by bicycle
15¢ for each paper delivered
deliver papers 6 days a week

Pages 58-59

LESSON OUTCOME

Subtract numbers with no regrouping and with regrouping tens as ones, hundreds as tens, or thousands as hundreds, minuends to 9999

Materials

models for thousands, hundreds, tens, ones, and/or a place-value pocket chart (optional)

Vocabulary

Magic Square, diagonally

Prerequisite Skills

Subtract with regrouping, minuends to 99; interpret place value for numerals with up to four digits

Checking Prerequisite Skills

Show the vertical form and subtract.

1. 72 − 5
2. 84 − 36
3. 50 − 29

1. 72 − 5 = 67
2. 84 − 36 = 48
3. 50 − 29 = 21

Tell what each digit means in the numeral.

4. 2816
   2 thousands
   8 hundreds
   1 ten
   6 ones
5. 4070
   4 thousands
   0 hundreds
   7 tens
   0 ones

Subtraction, Regrouping Tens, Hundreds, or Thousands

516 children had their eyes tested this year. 384 had their eyes tested last year. How many more had their eyes tested this year?

Subtract 384 from 516.

Subtract ones. Then try to subtract tens.

hundreds	tens	ones
5	1	6
3	8	4
		2

Cannot subtract 8 tens from 1 ten.

Regroup 5 hundreds, 1 ten as 4 hundreds, 11 tens.

4	11	
~~5~~	~~1~~	6
3	8	4
		2

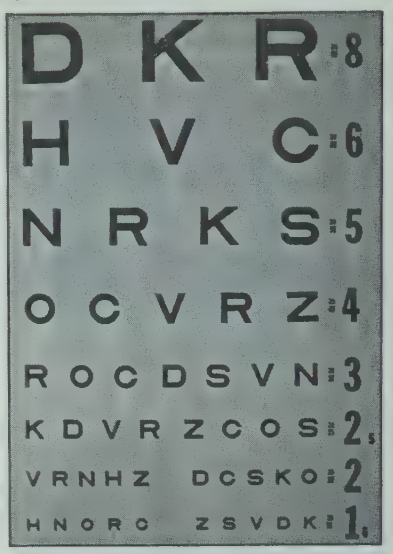
Subtract tens.

4	11	
~~5~~	~~1~~	6
3	8	4
	3	2

Subtract hundreds.

4	11	
~~5~~	~~1~~	6
3	8	4
1	3	2

132 more children were tested this year.



Working Together

Regroup to show 10 more tens.

	hundreds	tens	ones
1.	3	2	7

2. 4425

Regroup to show 10 more hundreds.

3. 5387
4. 8069

Complete each subtraction.

5. 549 − 292 = 257
6. 6502 − 3192 = 3310
7. 7468 − 3725 = 3743

Subtract.

8. 678 − 396 = 282
9. 2761 − 423 = 2338
10. $7285 − 5944 = 1341

58

LESSON ACTIVITY

Before Using the Pages

- Work several regrouping exercises, similar to the following, on the board to review one regrouping from the thousands', hundreds', or tens' place. Emphasize that 1 thousand equals 10 hundreds, 1 hundred equals 10 tens, and 1 ten equals 10 ones. Support the examples with models of thousands, hundreds, tens, and ones as needed and/or a place-value pocket chart.

	thousands	hundreds	tens	ones
6372	~~6~~ 5	~~3~~ 13	7	2
3283	3	~~2~~ 1	~~8~~ 18	3
4710	4	7	~~1~~ 0	~~0~~ 10

Using the Pages

- You may wish to begin by asking the students whether th have ever had their eyes tested and discussing importance of doing so on a regular basis. Many sch boards undertake an eye-testing program for children in elementary grades.

  The word problem is solved by a subtraction for whic is necessary to regroup 1 of the hundreds as 10 more te Lead the students through the steps, emphasizing w regrouping is not needed for the ones and why it is nee for the tens.

Working Together: Ex. 1-4 concentrate on the skill regrouping hundreds as tens (Ex. 1 and 2) and thousands hundreds (Ex. 3 and 4). This skill is applied in the partia completed exercises (Ex. 5-7). Use other similar exerci as required. For Ex. 8-10, students are required to compl all the steps on their own. Remind them that the differen in Ex.10 requires the symbol $. Question the stude about the regrouping shown in Ex. 5-7. Have them expl what was regrouped and why this was necessary.

This is a Magic Square.

Add across, down, or diagonally and get 93.

Try it.

1.

52	3	38	→ 93
17	31	45	→ ?
24	59	10	→ 93
↓ 93	↓ ?	↓ 93	↘ ?

Complete these Magic Squares so that all sums are 246.

$85 + 88 + ? = 246$

$173 + ? = 246$

Subtract 173 from 246.

2.

?	?	85
?	?	88
79	?	?

91	70	
76	82	
	94	73

3.

99	68	?	?
?	?	?	86
?	79	80	80
67	58	?	?

		25	54
73	41	46	
7			
		95	26

try this

Exercises

Subtract.

1. 589 − 294 = 295	2. 1405 − 122 = 1283	3. 7265 − 4555 = 2710	4. 2843 − 1212 = 1631
5. 786 − 459 = 327	6. 6086 − 536 = 5550	7. 529 − 487 = 42	8. 5685 − 1227 = 4458
9. 5209 − 3405 = 1804	10. 6249 − 3181 = 3068	11. 3842 − 637 = 3205	12. 549 − 406 = 143
13. \$9478 − 5517 = \$3961	14. \$678 − 384 = \$294	15. \$7277 − 1636 = \$5641	16. \$8543 − 3218 = \$5325

RELATED ACTIVITIES

- Once a Magic Square has been constructed, it can be used to generate other Magic Squares by adding, subtracting, multiplying, or dividing every number in the square by the same number. For example, every number in Magic Square A is multiplied by 12 to obtain Magic Square B.

A

2	7	6
9	5	1
4	3	8

B

24	84	72
108	60	12
48	36	96

You may use this procedure to obtain other Magic Squares. Leave some of the spaces blank and tell the students the sum that will help them complete the Magic Square, as in the *Try This* feature.

- Have students illustrate several of the subtractions on page 59 on a four-place abacus.

ercises: Some students may be able to complete the subtractions without showing the regrouping in writing. Students having difficulty should continue to record the regrouping.

y This: These exercises provide practice in addition and subtraction in completing Magic Squares. Students who are unfamiliar with Magic Squares may be shown the following simpler square to acquaint them with the procedure. Have them complete the Magic Square so that the sum is 15 across, down, and diagonally. Ensure that they understand what is meant by "diagonally".

2	?	?
9	?	?
?	?	8

Assessment

Subtract.

1. 264 − 132 = 132	2. 689 − 294 = 395	3. 6328 − 2417 = 3911	4. 9427 − 5309 = 4118

Pages 60-61

LESSON OUTCOME

Subtract numbers with two or three regroupings, minuends to 9999

Materials

models for thousands, hundreds, tens, ones, and/or a place-value pocket chart (optional)

Prerequisite Skills

Subtract numbers with one regrouping, minuends to 9999

Checking Prerequisite Skills

Subtract.

1. 462 − 49 = 413

2. 526 − 153 = 373

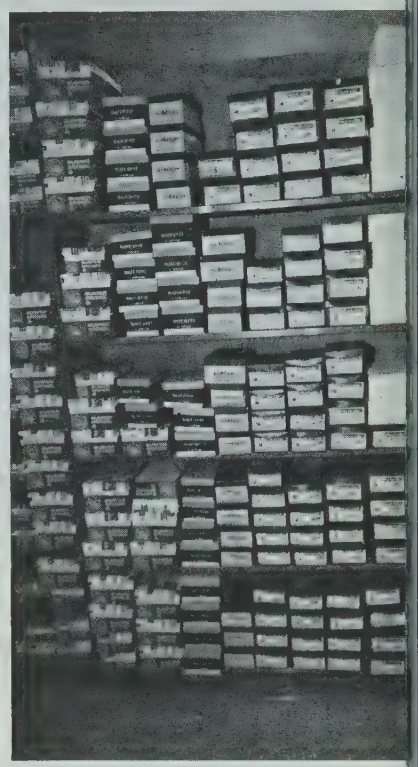
3. 6217 − 504 = 5713

4. 4209 − 1903 = 2306

Subtraction, Two or More Regroupings

The shoe store had 3432 pairs of shoes in stock one month. It sold 1775 pairs that month. How many pairs did it have left at the end of the month?

Subtract 1775 from 3432.



Regroup
3 tens, 2 ones as
2 tens, 12 ones.
Subtract ones.

$$\begin{array}{r} {\scriptstyle 2\ 12} \\ 3\,4\,\not{3}\,\not{2} \\ 1\,7\,7\,5 \\ \hline \qquad\quad 7 \end{array}$$

Regroup
4 hundreds, 2 tens as
3 hundreds, 12 tens.
Subtract tens.

$$\begin{array}{r} {\scriptstyle 3\ \not{2}\ 12} \\ 3\,\not{4}\,3\,\not{2} \\ 1\,7\,7\,5 \\ \hline \qquad 5\,7 \end{array}$$

Regroup
3 thousands, 3 hundreds as
2 thousands, 13 hundreds.
Subtract hundreds.

$$\begin{array}{r} {\scriptstyle 2\ \not{3}\ \not{2}\ 12} \\ \not{3}\,\not{4}\,3\,\not{2} \\ 1\,7\,7\,5 \\ \hline \qquad 6\,5\,7 \end{array}$$

Subtract thousands.

$$\begin{array}{r} {\scriptstyle 2\ \not{3}\ \not{2}\ 12} \\ \not{3}\,\not{4}\,3\,\not{2} \\ 1\,7\,7\,5 \\ \hline 1\,6\,5\,7 \end{array}$$

The shoe store had 1657 pairs of shoes at the end of the month.

60

LESSON ACTIVITY

Before Using the Pages

- Work several regrouping exercises, similar to the following, on the board. Support each example as needed with models of thousands, hundreds, tens, ones, and/or a place-value pocket chart. For each example, emphasize that the number represented is not changed, but the form of representing it is.

	thousands	hundreds	tens	ones
4812	4	~~8~~ 7	~~1~~ ~~0~~ 10	~~2~~ 12
3259	~~3~~ 2	~~2~~ ~~1~~ 11	~~5~~ 15	9
6483	~~6~~ 5	~~4~~ 14	~~8~~ 7	~~3~~ 13

Using the Pages

- The worked example illustrates a subtraction with th regroupings. Each step of the procedure is highlighted w red on the numerals and accompanied by instructio Question the students as you lead them through the ste For example, for the first step, ask,
  "Can five ones be subtracted from two ones?"
  "What regrouping is necessary?"
  "What will five ones be subtracted from?"
  "How can you tell that regrouping is needed bef subtracting the tens?"
  To review the steps of the subtraction have the stude close their books. Then work the same exercise on t board with them and compare the results with the work example on page 60. Review that the procedure is, usual, carried out in a right-to-left order.

Working Together: Ex. 1-4 present partially complet subtractions for the students to complete. For the regrou ing shown in each exercise, it is important to discuss wh was regrouped and why this was needed. For example,

Working Together

Regroup to show 10 more tens. Then complete the subtraction.

1. $\begin{array}{r} {}^{4}6{}^{11}5\not{1} \\ 195 \\ \hline 456 \end{array}$
2. $\begin{array}{r} {}^{1}6{}^{12}9\not{2}\not{2} \\ 3439 \\ \hline 3483 \end{array}$

Regroup to show 10 more hundreds. Then complete the subtraction.

3. $\begin{array}{r} {}^{1}8{}^{10}\not{2}\not{0}7 \\ 2253 \\ \hline 5954 \end{array}$
4. $\begin{array}{r} {}^{0}4{}^{13}\not{1}\not{1}\not{4}\not{1} \\ 2794 \\ \hline 1347 \end{array}$

Subtract by following the steps.

5.

$\begin{array}{r} 7416 \\ 2538 \\ \hline 4878 \end{array}$

Regroup and subtract.
Regroup and subtract.
Regroup and subtract.
Subtract.

Subtract.

6. $\begin{array}{r} 382 \\ 295 \\ \hline 87 \end{array}$
7. $\begin{array}{r} 4560 \\ 943 \\ \hline 3617 \end{array}$
8. $\begin{array}{r} 9874 \\ 2893 \\ \hline 6981 \end{array}$
9. $\begin{array}{r} \$2632 \\ 1758 \\ \hline 874 \end{array}$

Exercises

Subtract.

1. $\begin{array}{r} 923 \\ 678 \\ \hline 245 \end{array}$
2. $\begin{array}{r} 4292 \\ 703 \\ \hline 3589 \end{array}$
3. $\begin{array}{r} 3865 \\ 1552 \\ \hline 2313 \end{array}$
4. $\begin{array}{r} 9414 \\ 3682 \\ \hline 5732 \end{array}$
5. $\begin{array}{r} 3676 \\ 888 \\ \hline 2788 \end{array}$
6. $\begin{array}{r} 1845 \\ 175 \\ \hline 1670 \end{array}$
7. $\begin{array}{r} 5682 \\ 1764 \\ \hline 3918 \end{array}$
8. $\begin{array}{r} 4814 \\ 3536 \\ \hline 1278 \end{array}$
9. $\begin{array}{r} 7357 \\ 4544 \\ \hline 2813 \end{array}$
10. $\begin{array}{r} 7964 \\ 3965 \\ \hline 3999 \end{array}$
11. $\begin{array}{r} \$1438 \\ 742 \\ \hline \$\ 696 \end{array}$
12. $\begin{array}{r} \$3526 \\ 1869 \\ \hline \$1657 \end{array}$

Solve.

13. In one month, 2375 persons tried on shoes. 1685 persons bought at least one pair. How many persons tried on shoes but did not buy? 690
14. The shoe store sold 1775 pairs of shoes. 588 pairs were sports shoes. How many pairs did it sell that were not sports shoes? 1187
15. On one Special Sale day, the shoe store sold \$2130 worth of shoes for \$1768. How much less did the shoes cost on sale? \$362

61

RELATED ACTIVITIES

- Have students use an abacus to illustrate subtraction with two or more regroupings.
- Adapt the first activity in *Related Activities* on page T 43 for subtraction.

Ex. 1, 5 ones cannot be subtracted from 1 one, hence, 5 tens 1 one is regrouped as 4 tens 11 ones.

Ex. 5 might be completed on the board with each of four students completing one of the steps and explaining the step as it is shown. Prior to assigning Ex. 6-9, you may wish to ask questions for each, such as,
"Do you think you will need to regroup to subtract the ones (tens, hundreds)? Why?"

ercises: Encourage the students to space their exercises well to allow room for showing the regrouping neatly.

sessment

btract.

1. 381
   195
   186
2. 4793
   958
   3835
3. 6213
   3516
   2697
4. 4577
   1993
   2584

OBJECTIVE

Demonstrate competence in subtraction with no regrouping and with one, two, or three regroupings, minuends to 9999

Practice

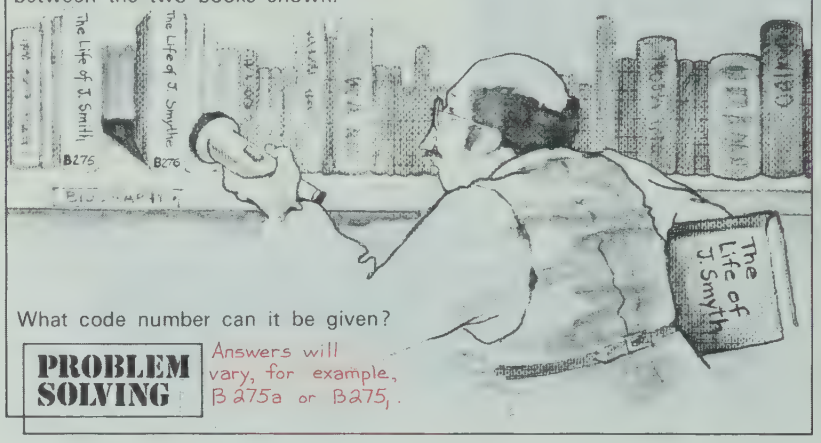
Subtract.

1. 5351 − 470 = 4881	2. 9254 − 3808 = 5446	3. 9104 − 5553 = 3551	4. 567 − 419 = 148	5. $6279 − 652 = $5627
6. 8836 − 5359 = 3477	7. 8673 − 1043 = 7630	8. 923 − 466 = 457	9. 7392 − 5877 = 1515	10. $4116 − 923 = $3193
11. 8588 − 7673 = 915	12. 2513 − 267 = 2246	13. 8316 − 747 = 7569	14. 5350 − 1978 = 3372	15. $7261 − 4883 = $2378

These exercises are not correct.
Copy the exercises and ring the errors you find. Then subtract correctly.

16. 3378 − 389 = 3011 2989	17. 8352 − 5811 = 3541 2541	18. 6218 − 3572 = 3746 2646	19. 6638 − 3748 = 2910 2890	20. $3782 − 126 = $2522 $3656
21. 9324 − 8406 = 1928 918	22. 6345 − 1239 = 5114 5106	23. 1164 − 435 = 739 729	24. 8743 − 6259 = 1484 2484	25. $3825 − 1867 = 2058 $1958

The new library book goes on the shelf between the two books shown.



What code number can it be given?

PROBLEM SOLVING

Answers will vary, for example, B275a or B275$_1$.

62

LESSON ACTIVITY

Using the Pages

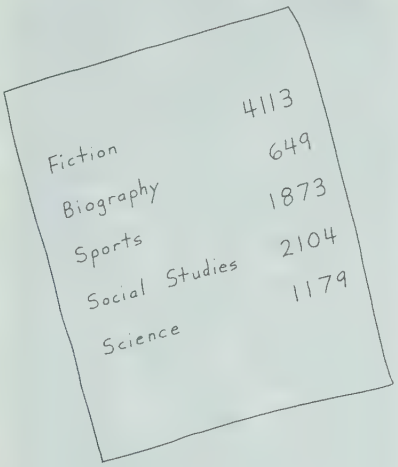
- If you feel there are too many exercises for the students to complete in one lesson, assign certain exercises to be completed at this time and leave the others for review and practice at a later date.

  The procedure described for Ex. 16-25 is similar to that given for page 41 of Unit 2; the students will likely remember the procedure. Caution them that some exercises may have more than one error.

  Point out that the list at the top of page 63 is relevant to the problems in Ex. 26-32. Ex. 32 will challenge some of the students. Both addition and subtraction will be necessary in the many steps required to complete the page for the record book. Students may need to return to this exercise at different times to complete it over several days.

Problem Solving: This particular problem involves the concepts of comparison and arranging in sequence. Some students may simply invent a system to solve the problem, f example, B275, B275a, B276. Other students may motivated to examine the numbering of books on t shelves of the library and perhaps ask the librarian what done in such situations.

The list shows how many library books there are.



Solve.

26. Are there more science books or sports books in the library? How many more? sports, 694

27. Are there more social studies books or science books? How many more? social studies, 925

28. Are there more fiction books or biography books? How many more? fiction, 3464

29. Are there more sports books or social studies books? How many more? social studies, 231

30. How many more science books would have to be ordered to have as many science books as fiction books? 2934

31. How many social studies and sports books are there? How many more (or fewer) of these are there than fiction books? 3977, 136 fewer

***32.** Someone spilled ink on the library's record book. Make a new page for the record book. Fill in the correct numbers.

	Old Total	Books Removed	New Books	New Total
Fiction	3728	146	531	4113
Biography	582	7	74	649
Sports	1637	79	315	1873
Social Studies	1948	25	181	2104
Science	982	58	255	1179
Total	8877	315	1356	9918

RELATED ACTIVITIES

- Problems similar to those on page 63 may be written for the number of each kind of book in your school library. Assign the task of finding the necessary information from the school librarian to a few capable students.

Pages 64-65

LESSON OUTCOME

Subtract with regrouping for zero tens and/or zero hundreds, minuends to 9999

Materials

models for thousands, hundreds, tens, and ones

Vocabulary

department store, baseball field

Prerequisite Skills

Subtract with regrouping, minuends to 9999

Checking Prerequisite Skills

Subtract.

1.	2.	3.
425	5174	3428
167	1467	2879
258	3707	549

Subtraction, Regrouping with Zeros

The department store sold 4000 hats. 2974 hats were in children's sizes. How many hats were in adult sizes?

Subtract 2974 from 4000.

4000 − 2974 — Cannot subtract 4 ones from 0 ones.

Think 4000 shows 4 thousands.
40 00 shows 40 hundreds.
400 0 shows 400 tens.

3 9 9 10
4000
2974
Regroup 400 tens, 0 ones as 399 tens, 10 ones.

3 9 9 10
4000
2974
1026
Then, subtract ones, tens, hundreds, and thousands.

1026 of the hats were in adult sizes.

Here are some other examples that show regrouping with zeros.

6 9 15	13	3 9 11	11
3705	4 8 9 11	4018	5 9 1 15
2158	5401	1361	6025
1547	2863	2657	3447
	2538		2578

64

LESSON ACTIVITY

Before Using the Pages

- For a number of thousands, for example, 2000, develop that 2 thousands, 20 hundreds, 200 tens, and 2000 ones all name the same number, *two thousand*. Where practical, illustrate using models. Summarize the concept in a list such as

  6000 is 6 thousands
  or 60 hundreds
  or 600 tens
  or 6000 ones.

  Use several examples.

- Write "600 tens 0 ones" on the board. Ask what number is represented. Ask if the number represented changes when 1 ten is replaced by 10 ones. Ask how many tens and ones there will be if 1 ten is replaced by 10 ones. Then write

	tens	ones
6000	~~600~~	~~0~~
	599	10

Use a similar procedure to develop other examples.

	hundreds	tens	ones
4002		~~400~~	~~2~~
		399	12
5036	50	~~3~~	6
	49	13	
6304	6	~~30~~	~~4~~
		29	14

Explain that working as suggested above with numbe that have zeros is helpful in subtraction exercises.

Using the Pages

- The worked example illustrates that subtracting 2974 fr 4000 can be facilitated by thinking of 4000 as 400 tens a then regrouping as 399 tens 10 ones. The fact that o stroke is used to "cross out" 400 helps to emphasize t procedure of regrouping in terms of tens. Discuss the ste shown for completing the subtraction, and have studer explain how each digit in the difference, 1026, is obtained

Working Together

Complete.

1. 3000 shows 3 thousands *or* 30 hundreds *or* 300 tens.
2. 2056 shows 2 thousands, 5 tens, 6 ones *or* 20 hundreds, 5 tens, 6 ones.
3. 4305 shows 4 thousands, 3 hundreds, 5 ones
   or 4 thousands, 30 tens, 5 ones.

4. ~~5000~~ 4 9 9 10
5. ~~3038~~ 29 13
6. ~~2405~~ 39 15
7. ~~1007~~ 99 12

Complete the regrouping and subtract.

8. ~~2000~~ 1 9 9 10
   1824
   176
9. ~~4602~~ 59 12
   1234
   3368
10. ~~3049~~ 29 14
    275
    4 277
11. ~~5405~~ 4 13 39 15
    1726
    3679

Subtract.

12.	13.	14.	15.	16.
6005	7046	2904	9025	$9101
2849	5392	1678	7146	1966
3156	1654	1226	1879	$7135

Exercises

Subtract.

1.	2.	3.	4.	5.
6048	7004	3800	7028	$1502
3265	3957	665	1154	579
2783	3047	3135	5874	$ 923
6.	**7.**	**8.**	**9.**	**10.**
802	3030	8000	4701	$2028
254	883	3078	2815	1932
548	2147	4922	1886	$ 96
11.	**12.**	**13.**	**14.**	**15.**
6073	1002	3201	5000	$2603
1478	266	2257	464	884
4595	736	944	4536	$1719
16.	**17.**	**18.**	**19.**	**20.**
4805	5048	7800	5036	$9007
3497	1369	4902	2856	3461
1308	3679	2898	2180	$5546

Solve.

21. The city had $5000 for a baseball field. It spent $4027. How much money was left? $973

22. $4027 was spent for a baseball field. $1375 of the money was used to buy the land. How much was used to complete the field? $2652

RELATED ACTIVITIES

- Students may be interested in finding pictures of sports equipment and other items whose prices show four digits, such as $20.00. Display the pictures for several days. Have the students subtract to find the difference of the prices of two similar items. Also, they may pretend to buy one item whose price is less than fifty dollars and find the amount of change they would receive if they pay for the item using a fifty-dollar bill.

The four examples at the bottom of page 64 provide an opportunity to discuss the kind of regrouping thought of for each minuend. For example, 3705 is thought of as 3 thousands 70 tens 5 ones and is regrouped as 3 thousands 69 tens 15 ones. 5401 is thought of as 5 thousands 40 tens 1 one and is regrouped first as 5 thousands 39 tens 11 ones. After subtracting the ones and the tens, 5 thousands 3 hundreds is regrouped as 4 thousands 13 hundreds. Discuss each example on the board to help the students understand the procedure.

rking Together: Ex. 1-3 provide practice in thinking of thousands as hundreds and as tens. This skill is applied in Ex. 4-7 in completing the regrouping of numbers. The skill of regrouping is then applied in the partially completed subtractions in Ex. 8-11. It may be necessary to use other similar exercises for any of these steps and also to illustrate the regrouping and subtraction using models. For Ex. 12-16, the students must think through all the steps on their own. Discuss these thoroughly on the board after they have had an opportunity to complete them.

Exercises: Observe the students as they work and give assistance as required.

Assessment

Subtract.

1.	2.	3.	4.
5008	4034	3062	7045
2149	2511	1871	2659
2859	1523	1191	4386

Pages 66-67

LESSON OUTCOME

Use addition to check subtraction

Prerequisite Skills

Add and subtract with regrouping, sums and minuends to 9999; write numerals for amounts of money using the symbol $

Checking Prerequisite Skills

Add.

1. 2347 + 1958 = 4305

2. 4015 + 2985 = 7000

Subtract.

3. 4015 − 1732 = 2283

4. 8000 − 4263 = 3737

Match the word name with the corresponding numeral.

5. $4.00 E

6. $6000 C

7. $19.75 D

8. $5025 A

9. $0.53 B

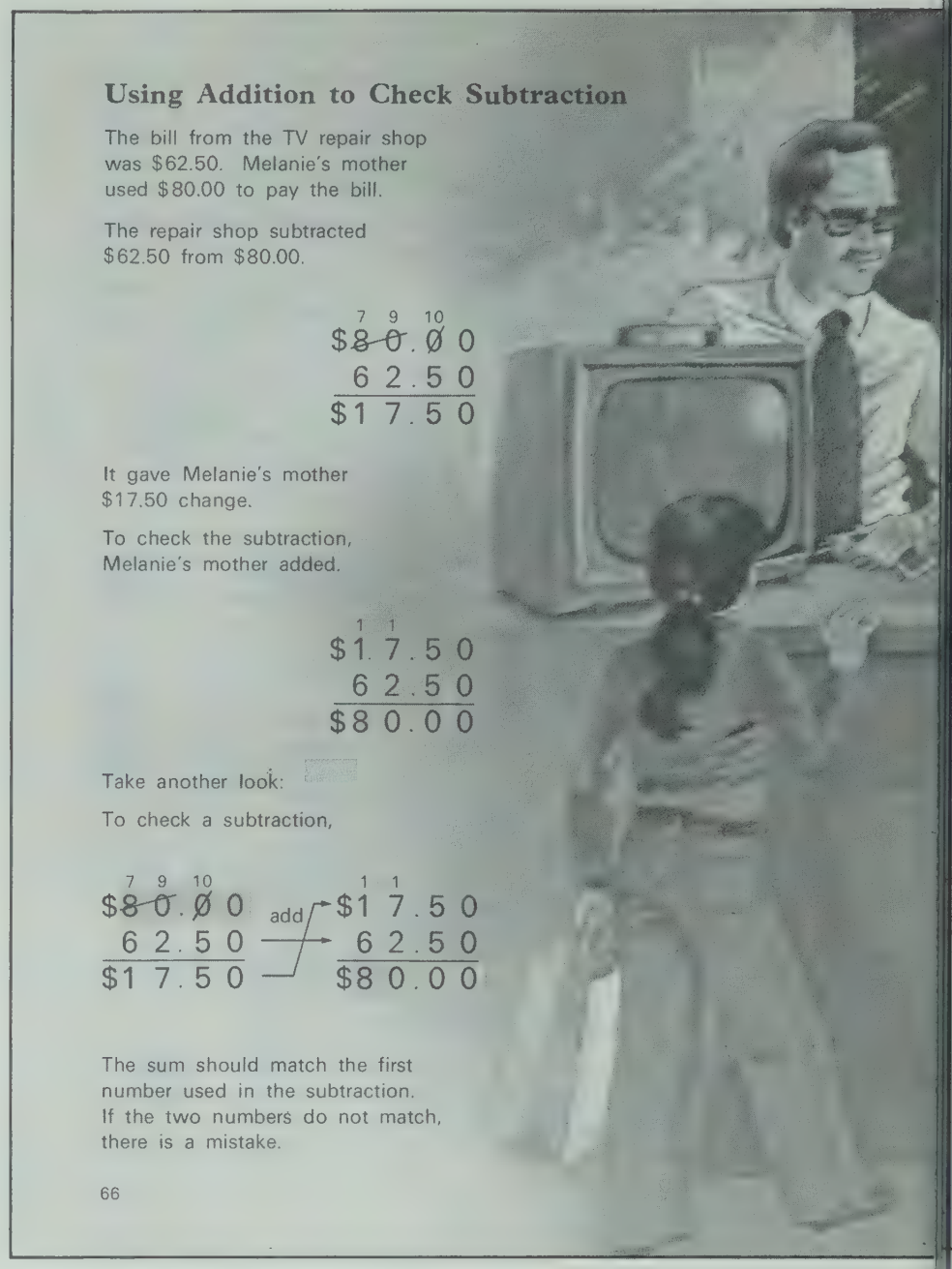
A five thousand twenty-five dollars

B fifty-three cents

C six thousand dollars

D nineteen dollars and seventy-five cents

E four dollars



Using Addition to Check Subtraction

The bill from the TV repair shop was $62.50. Melanie's mother used $80.00 to pay the bill.

The repair shop subtracted $62.50 from $80.00.

$$\begin{array}{r} {\scriptstyle 7\ 9\ 10} \\ \$8\not{0}.\not{0}0 \\ 62.50 \\ \hline \$17.50 \end{array}$$

It gave Melanie's mother $17.50 change.

To check the subtraction, Melanie's mother added.

$$\begin{array}{r} {\scriptstyle 1\ 1} \\ \$17.50 \\ 62.50 \\ \hline \$80.00 \end{array}$$

Take another look:

To check a subtraction,

$$\begin{array}{r} {\scriptstyle 7\ 9\ 10} \\ \$8\not{0}.\not{0}0 \\ 62.50 \\ \hline \$17.50 \end{array} \quad \text{add} \rightarrow \quad \begin{array}{r} {\scriptstyle 1\ 1} \\ \$17.50 \\ 62.50 \\ \hline \$80.00 \end{array}$$

The sum should match the first number used in the subtraction. If the two numbers do not match, there is a mistake.

66

LESSON ACTIVITY

Using the Pages

- Discuss that it is important for us to be able to determine whether the results of subtraction are correct. Have the students read the problem on page 66. Then have several students explain the situation in their own words. Question the students to help them review the main aspects of the problem: Melanie's mother paid a bill using $80.00; subtraction was used to find the amount of change she received; Melanie's mother used addition to check that the amount of change was correct. Emphasize which numbers were added and how the sum shows that the subtraction is correct. Note how the red on the numerals helps to highlight this.

Working Together: Have the students write the addition exercises for Ex. 1-4. Discuss the relationship of the sums to the minuends of the subtraction exercises. Have students show solutions on the board for Ex. 5-8 and explain their work. If possible, include an addition which indicates error in the subtraction process.

Exercises: Depending upon the ability of the students in y class, you may wish to have them show the addition writing for some of the exercises and perform the addit mentally for other exercises. For the word problems, ens that the students know what numerals to write for the b named, such as a ten-dollar bill (Ex. 16), a five-dollar (Ex. 17), and a twenty-dollar bill (Ex. 18). For Ex. some students may write 53¢ rather than $0.53 and subt this from 100¢ for a one-dollar bill. Ex. 20 is straight ward although it does involve more than one step. The s of "translating" two two-dollar bills to $4.00 will likely done mentally by most students.

Assessment

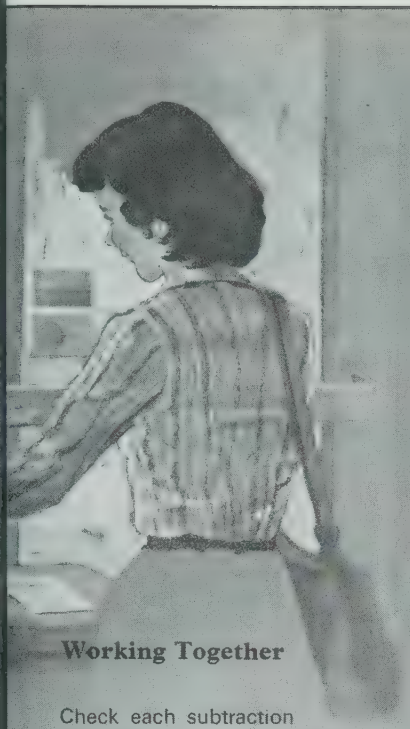
Subtract. Add to check.

1. 624 − 291 = 333

2. 245 − 169 = 76

3. 2043 − 1654 = 389

4. $9000 − 6842 = $2158



Working Together

Check each subtraction by adding the two numbers inside the ring.

1. 84 — 38, 46 — 46
2. 812 — 665, 147 — 147
3. 8083 — 3386, 4697 — 4697
4. $5000 — 811, $4189 — $4189

Subtract. Add to check.

5. 839 − 492 = 347
6. 7252 − 4457 = 2795
7. 7501 − 2795 = 4706
8. $20.05 − 10.78 = $9.27

Exercises

Subtract. Add to check.

1. 56 − 25 = 31
2. 735 − 201 = 534
3. $4865 − 1463 = $3402
4. 84 − 16 = 68
5. 8517 − 2285 = 6232
6. $7486 − 3931 = $3555
7. 742 − 473 = 269
8. 3297 − 659 = 2638
9. $3223 − 1741 = $1482
10. 946 − 648 = 298
11. 1246 − 259 = 987
12. $6320 − 4964 = $1356
13. 900 − 718 = 182
14. 9023 − 1638 = 7385
15. $5606 − 947 = $4659

Solve. Check by adding.

16. Repairs on his bike cost $4.82. Mike paid with a ten-dollar bill. How much change did he get? $5.18
17. The repair shop fixed Sara's boots for $3.65. She paid with a five-dollar bill. How much change did Sara get? $1.35
18. The plumber charged $17.07 to fix the sink. How much change did the plumber return from a twenty-dollar bill? $2.93
19. Tony had his slot car repaired at the hobby shop for $0.53. How much change did he get from a one-dollar bill? $0.47

*20. Emily's skateboard cost $2.29 to fix. She paid with two two-dollar bills. How much change did she get? $1.71

RELATED ACTIVITIES

- Have each student write four completed subtraction exercises such that two of the exercises have errors. Have the students exchange their papers and write addition exercises to check the subtractions. Then have them correct the errors in the subtractions.
- If a display of pictures was prepared as suggested in *Related Activities* on page T 69, students may work in pairs and refer to the items in the display. One student may be the clerk who subtracts to determine the amount of change. The other may be the customer who adds to determine if the amount of change is correct.

Pages 68-69

OBJECTIVE

Demonstrate competence in addition and subtraction with and without regrouping, and in using addition to check subtraction

Practice

Subtract. Add to check.

1. 946 − 572 = 374	**2.** 2603 − 439 = 2164	**3.** 5228 − 2644 = 2584	**4.** 930 − 657 = 273	**5.** \$6067 − 1292 = \$4775
6. 2005 − 616 = 1389	**7.** 8347 − 3748 = 4599	**8.** 500 − 379 = 121	**9.** 6214 − 3538 = 2676	**10.** \$7000 − 3405 = \$3595

Subtract to find the missing addend.

Example: For ▢ + 146 = 283, use 283 − 146.

11. ▢ + 146 = 283 (137)

12. 1884 + ▢ = 6187 (4303)

13. ▢ + 757 = 4604 (3847)

14. 395 + ▢ = 934 (539)

15. ▢ + 632 = 1125 (493)

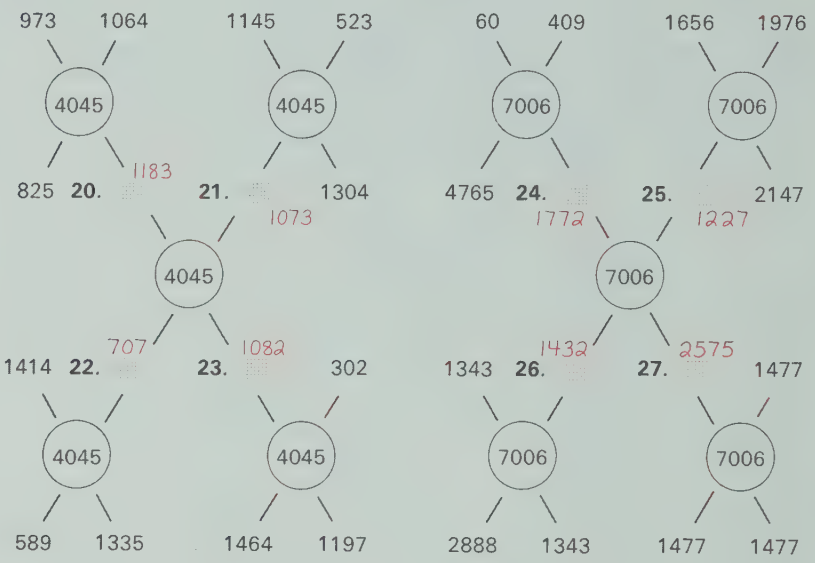
16. 406 + ▢ = 4064 (3658)

17. ▢ + 2852 = 3241 (389)

18. 547 + ▢ = 755 (208)

19. ▢ + 4758 = 7602 (2844)

Each circled number is the sum of the four numbers around it. Find the missing number.



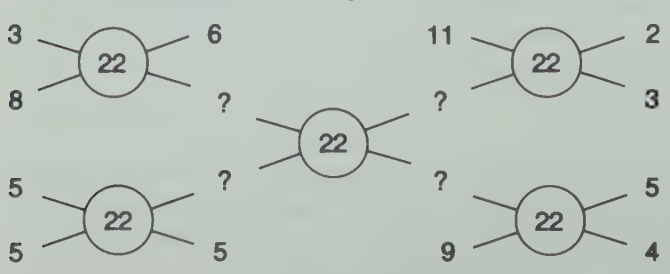
68

LESSON ACTIVITY

Using the Pages

- These exercises will provide practice with addition and subtraction concepts presented in Units 2 and 3. Rather than have the students attempt all the exercises at this time, select some to be completed now and plan to assign the rest at different times in subsequent weeks for practice and review.

  To help the students understand Ex. 20-27, you may wish to write the following simple "web" on the board, for which the calculations can be performed mentally.



Let the students think about the web and consider how find the missing numbers. They need to understand that is the sum of four numbers each time. All five sums sho be checked when the four missing numbers have be identified.

Point out that although Ex. 31, 35, and 39 are comple on the basis of patterns, the differences should be check by addition.

Try This: A similar set of exercises was provided for additi on page 41 of Unit 2. Through a process of guessing a testing, students can obtain several possibilities replacing the letters with digits. The exercises w three-digit numerals will provide a greater challen Postpone a discussion of the solutions for a few days so t students may attempt the exercises on several occasion

Answers will vary for all of these Examples are given

Do the first three subtractions in each set. Write the result for the fourth one by using the pattern.

28.	9655	**29.**	2687	**30.**	2030	**31.**	9108
	8421		1353		596		7574
	1234		1334		1434		1534

32.	7823	**33.**	8464	**34.**	8502	**35.**	9360
	5658		2852		6337		3748
	2165		5612		2165		5612

36.	2000	**37.**	3271	**38.**	5311	**39.**	6501
	779		829		1648		1617
	1221		2442		3663		4884

The differences form Magic Squares.

40.

7551	1017	9394
5632	407	7849
1919	610	1545
3713	2767	5212
2729	1409	3480
984	1358	1732
6843	8552	1035
5672	6446	238
1171	2106	797

Add across, down, or diagonally and get 4074 in this Magic Square.

41.

1147	678	6803	6232
725	123	4386	3948
422	555	2417	2284
8608	4117	1000	966
6590	1966	179	278
2018	2151	821	688
3940	7056	3023	8452
2055	5836	1537	7365
1885	1220	1486	1087
2000	6730	1400	4580
647	4978	446	2961
1353	1752	954	1619

Turn the page for more practice.

Replace the letters with three different digits to make a subtraction fact.

1. A 8
   B 3
   C 5

Replace the letters with six different digits to make a true subtraction statement.

2. AB 68
   CD 23
   EF 45

Replace the letters with nine different digits to make a true subtraction statement.

3. ABC 459
   DEF 176
   GHI 283

Make subtraction statements for these.

4. ABB 533
   CDD 488
   CA 45

5. ABC
   DAA
   DAA

   510
   255
   255

try this

RELATED ACTIVITIES

- Some students may be able to write number webs for other students to complete. The webs may be simple like the one shown in *Using the Pages* or more involved like those on page 68.

Page 70

OBJECTIVE

Demonstrate competence in using addition and subtraction to solve word problems

RELATED ACTIVITIES

• For further practice in solving problems, write, or have the students write, new problems similar to those on the page. The numbers in the problems may be changed and/or the question which is asked may be changed to imply the inverse operation. For example, for Ex. 42, use the numbers 967 and 482. In Ex. 43, the numbers may remain the same, but the question may be, "How many more dogs than cats were boarded this year?"

Add or subtract to solve each problem.

42. The veterinarian gave rabies shots to 753 dogs this year. Last year the vet gave shots to 575 dogs. How many more shots were given this year? 178

43. The kennel boarded 382 dogs and 128 cats this year. How many dogs and cats did it board this year in all? 510

44. At the pet store, Amy saw a plain collar for $2.98. A rhinestone collar cost $4.75. How much less was the plain collar? $1.77

45. Amy bought a collar for $2.98 and a leash for $2.54. How much did she spend for the collar and the leash together? $5.52

46. A rawhide bone costs $1.59. A rawhide pork chop costs $2.00. How much more does the pork chop cost than the bone? 41¢

47. The city collected 2504 stray dogs this year. Last year it collected 1879. How many more dogs did it collect this year? 625

48. The Animal Shelter spent $8000 to feed its animals this year. Last year it spent $7175. How much more did it spend this year than last year? $825

*__49.__ One dog owner got dog tags numbered from 1997 to 2012. If the owner has 16 dogs, were there enough tags for all the dogs? 16

The city collected 2504 stray dogs this year. 749 dogs were reclaimed by their owners. 688 dogs were claimed by new owners. How many dogs were not claimed? 1067

PROBLEM SOLVING

70

LESSON ACTIVITY

Using the Page

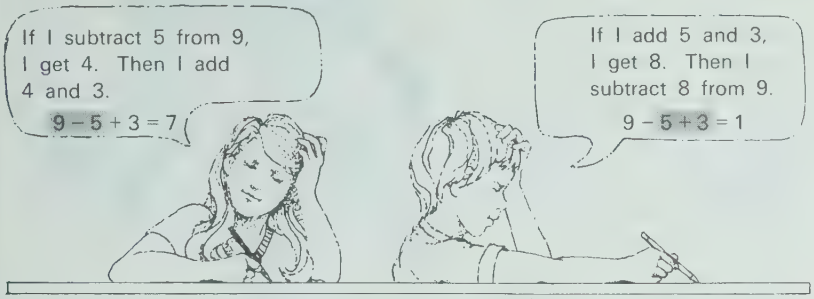
• Some students may need assistance, whereas others may be able to complete the word problems independently. For those who need assistance, have them read the problems aloud. Discuss which words in the problems indicate that addition should be used to solve the problems and which words indicate subtraction. Remind the students to write the answer for each problem in a sentence.

To solve Ex. 49, more than just subtraction is required. Some students may write the numeral for each tag and count the numerals. Some may invent a simpler problem and solve it, for example, dog tags numbered from 6 to 15. From this, it can be determined that the number of dog tags is one more than the difference of the two numbers.

Problem Solving: The solution involves two steps, either one addition and one subtraction, or two subtractions.

Addition and Subtraction Together

What is the result of $9 - 5 + 3$?



When both addition and subtraction are shown, **parentheses** tell which to do first.

first
$(9 - 5) + 3 = 7$
$9 - (5 + 3) = 1$
first

Working Together

Work inside the parentheses first.

1. $(5 + 3) + 2$ 10 **2.** $7 - (4 - 3)$ 6 **3.** $8 + (4 - 2)$ 10

Are two different results possible? If so, use parentheses to show how.

4 $(8-1)+3=10$, $8-(1+3)=4$
5 $(6+3)-2=7$, $6+(3-2)=7$
6 $(9-6)-2=1$, $9-(6-2)=5$

4. $8 - 1 + 3$ **5.** $6 + 3 - 2$ **6.** $9 - 6 - 2$

Exercises

1 $88-(42-36)=82$, $(88-42)-36=10$
4 $(406-118)+275=563$, $406-(118+275)=13$
5 $(542-205)-179=158$, $542-(205-179)=516$
6 $(1025-572)+358=811$, $1025-(572+358)=95$
9 $(6000-2165)+3035=6870$, $6000-(2165+3035)=800$

Are two different results possible? If so, use parentheses to show how.

1. $88 - 42 - 36$ **2.** $62 + 43 - 26$ no **3.** $84 + 178 + 157$ no
4. $406 - 118 + 275$ **5.** $542 - 205 - 179$ **6.** $1025 - 572 + 358$
7. $2674 + 892 + 1154$ no **8.** $2194 + 3806 - 1297$ no **9.** $6000 - 2165 + 3035$

Work inside the parentheses first.

10. $(25 + 59) + 73$ **11.** $25 + (59 + 73)$ **12.** $(387 - 125) + 68$
13. $(573 + 652) - 178$ **14.** $573 + (652 - 178)$ **15.** $4056 - (2180 + 1375)$
16. $(4056 - 2180) - 1375$ **17.** $4056 - (2180 - 1375)$ **18.** $(4056 - 2180) + 1375$

10 157 11 157 12 330
13 1047 14 1047 15 501
16 501 17 3251 18 3251

LESSON OUTCOME

Simplify a number phrase with three terms involving addition and/or subtraction by first completing the operation shown in parentheses

Vocabulary

parentheses

RELATED ACTIVITIES

- You may wish to provide students with a work sheet similar to the following. They are required to place the parentheses in the number sentence to show what must be done first to obtain the result given.

Draw parentheses to show what must be done first for the answer to be correct. Show your work.

1. $12 - (9 - 2) = 5$
2. $14 + (27 - 18) = 23$
3. $(318 - 129) + 111 = 300$

LESSON ACTIVITY

ing the Page

The worked example illustrates the need for parentheses to indicate which of addition or subtraction is to be performed first. Emphasize that the parentheses enclose either the first number with the second number or the third number with the second number. The order of the three numbers is not changed.

rking Together: Have students write their answers to Ex. 1-3. Then have them explain their answers orally. For each of these, the emphasis is given to completing the operation inside the parentheses first.

In completing Ex. 4-6 the students will discover from Ex. 5 that two different results do not always occur when addition is indicated first and then subtraction. Some students may discover that if the number phrase shows only addition, only one result is possible. Have them show their answers as illustrated in the worked example.

Exercises: Since these exercises involve larger numbers, the numbers will have to be written in vertical form. The following format shown for Ex. 1 and 10 may be used.

1.
$$\begin{array}{r} 88 \\ -\ 42 \\ \hline 46 \end{array} \qquad \begin{array}{r} 46 \\ -\ 36 \\ \hline 10 \end{array} \qquad (88 - 42) - 36 = 10$$

$$\begin{array}{r} 42 \\ -\ 36 \\ \hline 6 \end{array} \qquad \begin{array}{r} 88 \\ -\ 6 \\ \hline 82 \end{array} \qquad 88 - (42 - 36) = 82$$

10.
$$\begin{array}{r} 25 \\ +\ 59 \\ \hline 84 \end{array} \qquad \begin{array}{r} 84 \\ +\ 73 \\ \hline 157 \end{array} \qquad (25 + 59) + 73 = 157$$

Assessment

Work inside the parentheses first.

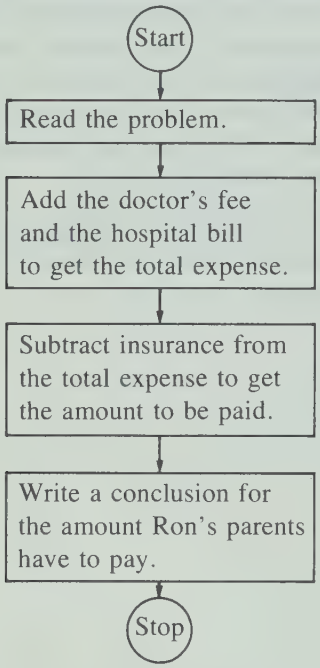
1. $(6241 - 4026) - 877$ 1338 **2.** $8347 - (2529 + 3619)$ 2199

OBJECTIVE

Solve problems involving two or more steps

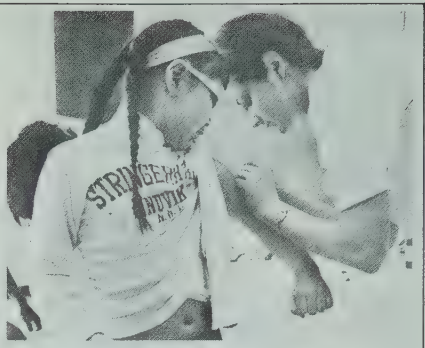
RELATED ACTIVITIES

• Some students may be interested in showing the main steps needed to solve a problem in a simple "flow chart". For Ex. 5, for example, the following might be shown.


Start
Read the problem.
Add the doctor's fee and the hospital bill to get the total expense.
Subtract insurance from the total expense to get the amount to be paid.
Write a conclusion for the amount Ron's parents have to pay.
Stop

• Charts similar to the one above may be drawn to show the steps for solving an everyday problem such as preparing toast for breakfast or brushing one's teeth.

Solving Problems in Two or More Steps



Sometimes it takes more than one step to solve a problem.

495 children at Macdonald School and 347 children at Laurier School had to have booster shots. The nurses gave 516 shots on Monday. How many children still had to have booster shots?

Add. $\overset{1\,1}{495} + 347 = 842$ children in all.

Subtract. $\overset{3\,12}{8\not4\not2} - 516 = 326$ still need shots.

Solve. Show the steps for each problem.

1. On Monday the nurses gave shots to 218 of the 347 children at Laurier School. On Tuesday they gave shots to 121 more. How many children at Laurier School still needed shots? 8
2. There were 286 patients in the hospital yesterday. 35 were admitted last night. 62 were released today and 49 more were admitted. Now how many are in the hospital? 308
3. One doctor worked 102 h (hours) one week. She spent 35 h in the office, 58 h in the hospital, and the rest of the time on home visits. How many hours did she spend on home visits that week? 9
4. The doctor's fee for Ron's baby sister was $235. The hospital costs were $875. Insurance paid $875 for the hospital and $200 for the doctor. How much did Ron's parents have to pay? $35
5. The doctor's fee was $75 for taking out Ron's tonsils. The hospital bill was $175. Insurance paid $189. How much did Ron's parents have to pay? $61
6. One day the Blood Center had 1204 units of blood. It sent 378 units to one hospital and 548 to another. It received 762 units on a blood drive. How many units did it have at the end of the day? 1040

PROBLEM SOLVING

72

LESSON ACTIVITY

Using the Page

• The students have likely encountered problems earlier for which the solutions required more than one step. Some of the starred exercises on previous pages have involved such problems.

Begin by discussing the photograph of a child receiving a booster shot. This provides an opportunity to discuss the importance of booster shots and why the administering of them is often carried out at schools.

Have a student read the title and the introductory statement. Read the problem slowly to the students. Discuss that the nurse gives shots to children at one school and then, when finished, goes to the other school to give those children their shots. Develop that in order to find how many still need shots it is necessary first to find how many children in all need shots and then subtract. Relate each step to the corresponding exercise shown.

Some students who have reading difficulties may successful in determining the necessary steps for solv the problems if the problems are read to them. You mi consider having a student who reads well work wit student who has difficulty reading.

Checking Up

Subtract.

1. 59 − 31 = 28	2. 775 − 421 = 354	3. 6347 − 5041 = 1306	4. 64 − 26 = 38	5. \$283 − 39 = \$244
6. 3694 − 1178 = 2516	7. 126 − 54 = 72	8. 987 − 295 = 692	9. 6963 − 2572 = 4391	10. \$3488 − 2734 = \$754
11. 5268 − 731 = 4537	12. 5084 − 1663 = 3421	13. 223 − 64 = 159	14. 522 − 236 = 286	15. \$5620 − 4047 = \$1573
16. 3183 − 1565 = 1618	17. 1574 − 909 = 665	18. 8260 − 3458 = 4802	19. 2117 − 1171 = 946	20. \$8716 − 923 = \$7793
21. 7119 − 4493 = 2626	22. 4437 − 3798 = 639	23. 8232 − 4867 = 3365	24. 3214 − 436 = 2778	25. \$6324 − 3578 = \$2746
26. 9000 − 5835 = 3165	27. 1004 − 265 = 739	28. 4006 − 526 = 3480	29. 6062 − 4763 = 1299	30. \$5029 − 2487 = \$2542
31. 2086 − 198 = 1888	32. 903 − 806 = 97	33. 9603 − 4798 = 4805	34. 1305 − 247 = 1058	35. \$7005 − 2968 = \$4037

Add or subtract as shown.

36. (348 + 757) − 285 820

37. (500 − 274) + 894 1120

38. 1361 + (714 − 75) 2000

39. (2022 − 975) − 548 499

40. 6413 − (2895 + 1839) 1679

41. 3207 − (2000 − 641) 1848

42. The bicycle shop ordered 1112 bicycles last year. It sold 1074. How many did it have left in stock? 38

43. The bicycle shop sold 1074 bicycles last year. 375 have already needed repairs. How many have not needed repairs? 699

44. The bicycle shop has sold 698 bicycles this year. Last year it sold 1074. How many fewer has it sold this year? 376

45. One basic model bicycle costs \$75.59. Fully equipped it costs \$94.00. How much more does it cost fully equipped? \$18.41

Page 73

OBJECTIVE

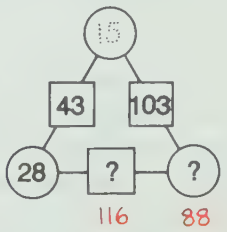
Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Students may practice subtraction by rolling four dice twice to obtain two four-digit numbers. The lesser number is subtracted from the greater number.
- The second activity described in *Related Activities* on page T 53 may be adapted for subtraction. Have the students use a felt strip of a contrasting color to "cross out" numerals in the minuend.

thousands	hundreds	tens	ones
	2	13	
		~~3~~	15
2	~~3~~	~~4~~	~~5~~
− 1	6	6	8
		7	7

- Diagrams similar to the following may be used to practice addition and subtraction (see page T 360). Addends are shown in the circles. Sums are shown in the squares.



Skills	Exercises	Related Pages
Subtract, no regrouping	1	T 58-T 59
	2, 3	T 62-T 63
Subtract, one regrouping	4	T 58-T 59
	5-12	T 62-T 63
Subtract, one, two, or three regroupings	13-25	T 64-T 65
Subtract with regrouping, for zero tens and/or zero hundreds in the minuend	26-35	T 68-T 69
Simplify number phrases involving addition and/or subtraction	36-41	T 75
Solve subtraction problems	42-45	

Comments

The chart showing the skills required for the exercises on this page facilitates locating an area of difficulty. Usually students who answer correctly almost all the exercises for a skill have mastered that skill. Students should review a skill for which they answer only half of the exercises correctly. If students answer less than half of the exercises correctly, that skill should be retaught.

Students who tend to forget basic subtraction facts require a short daily drill. Games or activities suggested in Unit 3 provide interesting methods of drill. Students having difficulty with word problems may benefit from a study of vocabulary usually associated with the operations of addition and subtraction. Some examples are given below.

Addition	Subtraction
How many in all?	How many fewer?
How many altogether?	How many more?
What is the sum?	How many are left?
	What is the difference?

Unit 4 Overview

Geometry

This unit deals with the geometry of shapes and includes various polygons. These provide opportunities to study lines, line segments, angles, vertices, sides, and congruency of shapes. The unit also includes a brief study of line symmetry, solids, and the circle. Besides the usual *Checking Up* at the end of the unit, a comprehensive assessment of skills in addition, subtraction, and related problem solving is provided.

Prerequisite Skills

- recognize shapes that are alike
- identify a straight path

Unit Outcomes

- identify and draw shapes having line symmetry
- identify and show lines of symmetry
- identify, name, and draw lines, line segments, and angles
- classify angles as larger than, smaller than, or the same size as a right angle
- identify and draw polygons
- identify the angles and sides of polygons
- name triangles and their angles and sides
- identify and draw circles
- identify and name parts of a circle (center, radius, diameter)
- trace a shape to determine whether it is congruent to another shape
- identify and count the vertices, edges, and faces of a solid
- recognize two-dimensional patterns for solid shapes
- organize information for solving a problem

Background

At this level, students acquire geometric concepts through manipulation and observation. In some instances they can make comparisons visually and draw conclusions, while in others they are obliged to use tracings and cutouts. Certain basic concepts underlie all aspects of geometry; namely, space, plane, point, line, line segment, ray, and angle. Some of these concepts are undefined and basic assumptions are made concerning them.

The term *point* is undefined. On the abstract level, a geometric point is a particular location in space. A point is immovable and has no length, width, or thickness. The closest approximation to a point is the smallest dot on paper or the point of a needle. All of the other geometric terms are derived in terms of points. These are discussed here as a background for the teacher. It is not expected that the students should describe them in this manner.

Space is considered to be the set of all points.

A *plane* is the set of all points on a flat surface whose length and width extend endlessly.

A *line* is thought of as a set of points forming a straight path that continues without end in opposite directions.

A *line segment* is part of a line. It has two end points and includes all the points that lie between them.

A *ray* is part of a line. It has one end point and continues without end in one direction.

An *angle* is formed by two rays having a common end point which is called a *vertex*.

The preceding terms which deal primarily with plane figure called *polygons*, are useful in defining features of solid figu having plane surfaces.

A *face* of a solid is part of a plane.

An *edge* of a solid is the line segment formed where two fac of the solid meet.

A *vertex* of a solid is the common end point of three or mo edges.

Polygons are closed figures composed of line segments. T least number of line segments, or *sides*, of a polygon is three. *triangle* has three sides. A *quadrilateral* has four sides. quadrilateral with four right angles is called a *rectangle*. In rectangle, opposite sides are equal in length. If a rectangle h all four sides of equal length, it is called a *square*. A *pentag* has five sides, a *hexagon* has six sides, and an *octagon* has eig sides. A polygon is said to be a *regular polygon* if the sides a of equal length and the angles are of equal measure.

If two figures have the same size and shape, they are said be *congruent*. In terms of their points, they may be matched o to one. Figures which have *line symmetry* can be divided in two congruent parts, but one of the parts must be flipped over match the other part.

A *circle* is a closed figure, but, unlike a polygon, it has no li segments. It consists of all the points in a plane which a equidistant from one point called the *center*. The terms *radi* and *diameter* relate to the center of the circle for their meanin A radius is a line segment from the center to a point on the circ a diameter is a line segment that has its end points on the circ and passes through the center.

Solids or three-dimensional figures are also studied, but the formal names are not encountered at this time. The students a directed to examine them in terms of the shapes of their fac and the number of each. They also count the vertices and t edges. An interesting and important relationship between t number of vertices, faces, and edges was discovered by Leona Euler, a mathematician who lived in Europe from 1707 to 178 He found that the sum of the number of vertices and the numb of faces of a solid is equal to the number of edges plus 2. H discovery is called Euler's formula and is represented by t equation $V + F = E + 2$. Stated in other ways, the sum of t number of vertices and the number of faces of a solid is always greater than the number of edges, or the number of edges always 2 less than the sum of the number of vertices and t number of faces of a solid.

The problem-solving lesson in this unit introduces the use of tally system for organizing data. This is one of the simple techniques since it involves a one-to-one correspondenc between items and tallies. Primitive man used similar metho when he used pebbles, notches on a stick, and knots on a ro for recording numbers. Of course, our use of tallies is only means to an end and is followed by counting the marks a writing the proper numerals.

Teaching Strategies

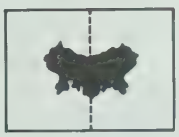
This unit offers a change of pace from the study of numbe and operations. If the class has been grouped by ability f instruction in the preceding units, the students may be regroup or taken as a single group since the concepts and skills for th unit are not dependent on number.

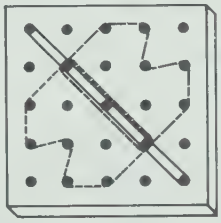
The activities require, in some instances, special materia such as tracing paper, semi-transparent plexiglass mirror

lboard strips and paper fasteners, and models of plane and d figures. If the supply of some items is limited, grouping be required so that every student is able to have direct erience with the materials. This procedure would provide e for remedial work and practice in addition and subtraction, or enrichment activities for those students who must wait r turn to use the materials. For this purpose, you may wish to the *Try This* features on pages 75 and 77, the *Keeping Sharp* rcises on pages 83 and 89, and the *Checking Skills* exercises pages 92 and 93.

n *Starting Points in Mathematics 3*, the unit on geometry ins with a study of three-dimensional shapes and ends with s, line segments, and points. In this book, the development ceeds in the opposite order, using the basic elements of nts and line segments upon which to build understanding of -dimensional and three-dimensional shapes. Each new cept or term is dependent on previous ones for its meaning.

he first lesson deals with line symmetry and is applied narily to simple drawings, including some polygons. While blots are an interesting approach to line symmetry, they are re artistic than geometric. Nevertheless, they may be used as her examples of line symmetry. Line symmetry may also be lied using three rubber bands on a geoboard — one to cate the line of symmetry, one color to outline a shape on side, and another color to complete the symmetrical shape he other side.





he students will probably be familiar with the terms *triangle*, *angle*, *square*, and *circle*, but will not likely have ountered the terms *quadrilateral*, *pentagon*, *hexagon*, and *agon*. It is suggested that models of these made from pipe aners and straws be hung with their names so that the students see them frequently and learn to recognize them. (See *ated Activities* on page T 95.) It might also be helpful to build hart of definitions on the chalkboard or display board as they met in the textbook. These, too, would provide reinforce- nt in the days following the lessons.

n working with the three-dimensional shapes on pages 88 and and especially with Ex. 1-4, you may wish to alter the order he columns, interchanging "edges" and "faces". With the umns in the order *vertices*, *faces*, and *edges*, some students ht be able to see the relationship which is embodied in er's formula. They would be delighted to know that they had scovered" what the famous mathematician discovered over years ago.

uggestions are offered in the lesson outlines for use of the r sections of *Checking Skills* on pages 92 and 93. There are separate skills in addition and six in subtraction. A chart ng the names of the students and these twelve skills would be icularly useful in determining group needs and individual ds for reteaching, review, and practice. The students nsélves may be interested in seeing their own check lists and ve satisfaction as each sub-skill is mastered in follow-up rk.

Materials

tracing paper, semi-transparent plexiglass mirrors
pictures of objects that suggest line symmetry
two narrow strips of cardboard, a pronged paper fastener, and a square corner for each student
demonstration clock
round object, such as a coin, for each student
pieces of string and a rubber band for each student
set of solid shapes, including a hexagonal prism
shapes cut from copies of pages T 353 - T 356
patterns prepared from those on pages T 357 and T 358 for each student

Vocabulary

line symmetry
line of symmetry
straight path
line, line segment
arrowhead
points, end points
angle, right angle
vertex, vertices
center, radius, diameter
side, figure, congruent
edge, face
rectangle
square
triangle
polygon
quadrilateral
pentagon
hexagon
octagon
circle
solid
tally sheet

Pages 74-75

LESSON OUTCOME

Identify and draw shapes having line symmetry; identify and show lines of symmetry

Materials

a blank sheet of paper and scissors for each student, tracing paper for each student, semi-transparent plexiglass mirrors, pictures of objects that suggest line symmetry

Vocabulary

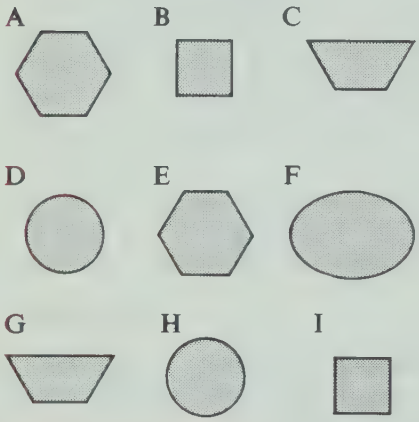
line symmetry, line of symmetry, rectangle, square

Prerequisite Skills

Recognize shapes that are alike

Checking Prerequisite Skills

1. Name four pairs of shapes that are alike.



A and E; B and I
C and G; D and H

4 GEOMETRY

Line Symmetry

The "water line" separates this picture into two parts that are alike.

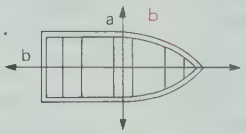
The picture has **line symmetry**.

A line that separates a picture into two parts that are alike is a **line of symmetry**.

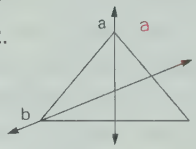
Working Together

Which is a line of symmetry?

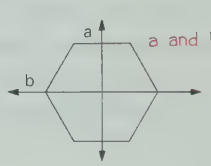
1.



2.



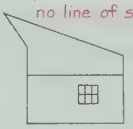
3.



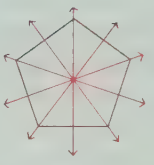
Use tracing paper. Trace around each shape. Then sketch lines of symmetry.

4.

5. no line of symmetry



6.



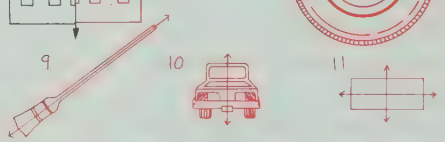
The lines shown are lines of symmetry. Sketch the part of each picture shown. Then sketch the matching part to complete the shape.

7.

8.

A picture of each of these can have line symmetry. Draw a picture of each. Show a line of symmetry.

9. a broom
10. a car
11. a rectangle



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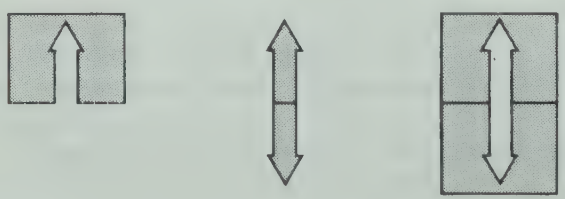
LESSON ACTIVITY

Before Using the Pages

- Have each student fold a blank sheet of paper and cut a shape around the fold. Have the students unfold their shapes and, using a ruler, draw a line along the crease. Ask them what they notice about the shapes they made.



Using the Pages

- Line symmetry is sometimes referred to as *reflection symmetry*. The photograph illustrates that the "water line" separates the picture into two parts that are alike — the scene and the reflection of the scene in the water. Have t students comment on the photograph. Lead them to sugg that the water line in the photograph is similar to the fo line, or crease, in the cutouts completed earlier, and that t water line divides the photograph into two similar par Introduce the terms *line symmetry* and *line of symmetry*

Have the students trace the line of symmetry in t photograph with their fingers. Also, have them mat objects with their images. For example, have them point a barn window in the scene and point to the image of t window in the reflection. You may wish to develop that object and its image appear to be the same distance from t line of symmetry and are on opposite sides of the lin Encourage the students to use the new vocabulary as th discuss the symmetry.

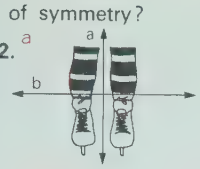
Working Together: Ex. 1-3 show lines which may or may n be lines of symmetry. The skill involved is recognizi whether a line divides a shape into two parts that are alik

Exercises

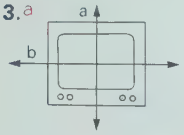
Which line is a line of symmetry?

1. a

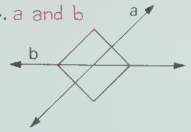
2. a



3. a



4. a and b

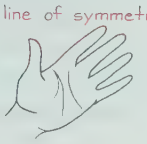


Copy each picture that shows line symmetry. Then draw lines of symmetry.

no line of symmetry

5.

6.

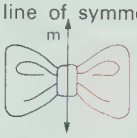


7.

8.

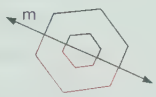
Copy and complete each picture so that line m is a line of symmetry.

9.



10.

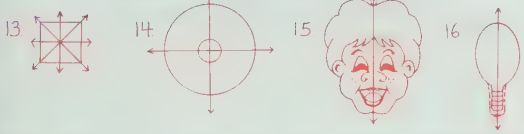
11.



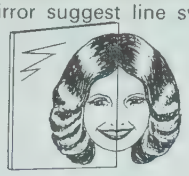
12.

Draw a picture for each of these. Show a line of symmetry.

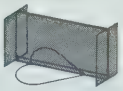
13. a square
14. a cake pan
15. your face
16. a light bulb



A shape and its reflection in a mirror suggest line symmetry.



A shape and its reflection in the Mira™ can help you check for line symmetry.



Look through this side. Carefully move the Mira and try to match the reflection with the part of the shape on the other side.

1. Find some pictures that suggest line symmetry. Check for line symmetry using the Mira.

A shape and its reflection in the Mira can help you draw shapes that have line symmetry.

Look through this side. On the other side, draw the part of the shape suggested by the reflection.

2. Sketch a shape like this. Use the Mira along the line to help you complete a shape having line symmetry.

try this

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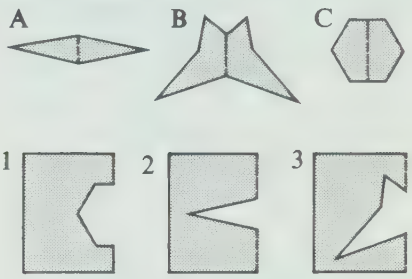
RELATED ACTIVITIES

- Have the students use a plexiglass mirror, such as the Mira™, to investigate the line symmetry of the photograph and the pictures on these pages.
- The students may wish to find which letters of the alphabet and which of the digits from 0 to 9 have line symmetry.
- The shapes that the students prepared in *Before Using the Pages* will provide an interesting display which can be used to reinforce the concept of line symmetry. Display the unfolded cutouts in one group and the folded sheets from the cutouts in another group. Label the cutouts (A, B, C, . . .) and the sheets (1, 2, 3, . . .). Have the students identify the sheet that matches each cutout.



- Provide students with copies of pages T 353-T 356. Have them cut out the shapes and test them for line symmetry by folding and/or by using a plexiglass mirror.

In Ex. 3, students encounter a shape that has more than one line of symmetry. Provide tracing paper for Ex. 4-6 and discuss the students' results. For example, the shape in Ex. 5 has no lines of symmetry and the shape in Ex. 6 has five lines of symmetry. Point out that the objects named in Ex. 9 and 10 do not necessarily have line symmetry, but they can be drawn so that they are symmetric. You may wish to display some of the students' drawings for a few days.

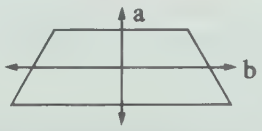
ercises: Point out that for Ex. 5-8, there is no need to copy the shape if it has no lines of symmetry. Ex. 10 provides an opportunity to discuss the line symmetry of certain letters of the alphabet.

y This: A semi-transparent plexiglass mirror, such as the Mira™, is an excellent device for exploring line symmetry. As a mirror, it shows the reflection of an object. Being semi-transparent, it enables students to match the reflection in testing for line symmetry (Ex. 1) or to trace the reflection in drawing a symmetric shape (Ex. 2).

Assessment

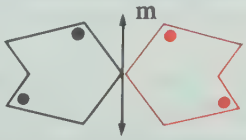
Which line is a line of symmetry? a

1.



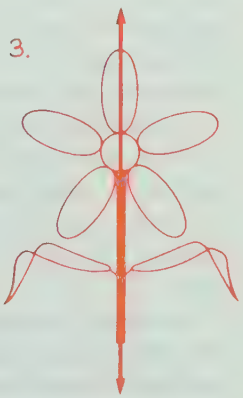
Line m is a line of symmetry. Copy and complete the picture.

2.



Draw a picture and show a line of symmetry for

3. a flower.



Pages 76-77

LESSON OUTCOME

Identify, name, and draw lines and line segments

Materials

straight edge for each student

Vocabulary

straight line, line, line segment, arrowhead, points, end points

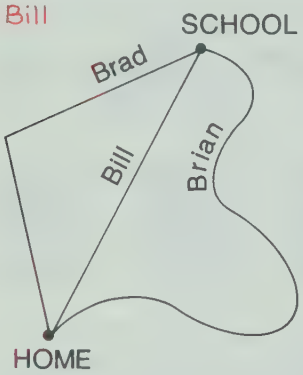
Prerequisite Skills

Identify a straight path

Checking Prerequisite Skills

Which brother walked a straight path home from school?

1. Bill

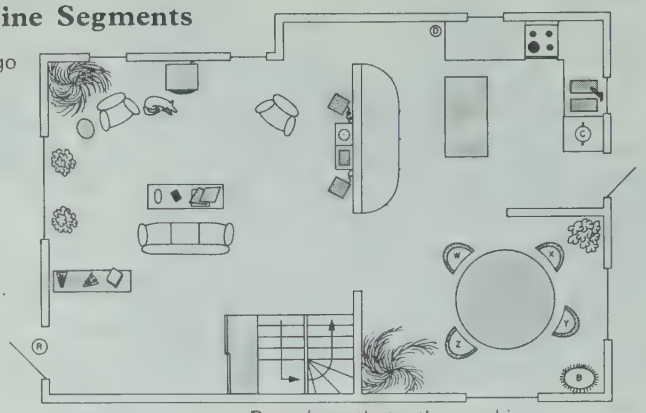


Lines and Line Segments

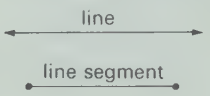
Can Roger (R) go *straight* to the cookie jar (C)?

A straight edge placed between Roger and the cookie jar will touch nothing else in the home.

Roger and the cookie jar are in line.



A **line** is a straight path that continues without end.



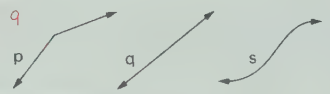
Roger's path to the cookie jar suggests part of a line known as a **line segment**.

A line segment is a straight path that connects two points.

Working Together

Which shows a line, p, q, or s?

1. q



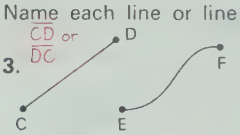
A line is named by naming two of its points in either order.

Example:

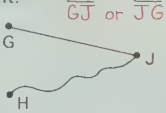
$\overleftrightarrow{AB}$ or $\overleftrightarrow{BA}$

Name each line or line segment.

3. $\overline{CD}$ or $\overline{DC}$



4. $\overline{GJ}$ or $\overline{JG}$



Use a straight edge to draw these. Label the points.

6. $\overline{RS}$ line segment RS

7. $\overleftrightarrow{MN}$ line MN

Which shows a line segment, R to S, S to T, or T to U?

2. T to U

A line segment is named by naming its **end points**.

Example:

$\overline{DE}$ or $\overline{ED}$

5. $\overline{LJ}$ or $\overline{JL}$, $\overline{LK}$ or $\overline{KL}$, $\overleftrightarrow{LK}$ or $\overleftrightarrow{KL}$

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LESSON ACTIVITY

Using the Pages

- Begin with a discussion of the illustration. Have students name objects they recognize. Ask questions such as,
  "What shape is the kitchen table?"
  "What shape is the dining table?"

  Read the question that introduces the situation and have each student use a straight edge to show that Roger can walk in a straight path to the cookie jar, without touching anything else in the home. Have the students use the straight edge to find if Roger can walk straight to the television set.

  Introduce the terms *line* and *line segment*. Discuss that the arrowheads on the model of a line indicate that the line continues without end. Emphasize that a line has no end, whereas a line segment has a beginning and an end, since it connects two points. It is important that students understand that for each, the path is a straight path.

Working Together: Have students give reasons orally for the choices in Ex. 1 and 2. Before the students begin the remaining exercises, discuss the way in which lines and line segments are named, drawing attention to the term *end points* for line segments. Note the symbols drawn above the letters in naming lines and line segments, for example, $\overleftrightarrow{AB}$ and $\overline{CD}$.

Exercises: Have the students use their straight edges for Ex. 9-12. Ex. 11 may provide an opportunity to discuss three segments of the same straight line if any of the students draw three collinear points, for example,

as opposed to

Answers to Ex. 15 may vary. Some students may suggest that a straight path may be possible because Barky can walk under the table rather than around it.

1. D 6, 1:2, 2:5, 3:5, 4:4, 5:5, 6:6, 7:3, 8 7, 9:6

Exercises

Is it or is it not

1. a line segment? no
2. line segment BC? no
3. $\overleftrightarrow{RQ}$? yes
4. $\overline{XY}$? no

Name all the lines shown.

5. $\overleftrightarrow{ED}$ or $\overleftrightarrow{DF}$ or $\overleftrightarrow{EF}$
6. $\overleftrightarrow{KH}$, $\overleftrightarrow{GH}$, $\overleftrightarrow{KG}$

Name all the line segments shown.

7. $\overline{DF}$, $\overline{FE}$, $\overline{ED}$
8. $\overline{PW}$, $\overline{SW}$, $\overline{TW}$, $\overline{UW}$, $\overline{VW}$

Draw and label these.

9. $\overleftrightarrow{BC}$
10. $\overline{RS}$
11. points X, Y, Z and then $\overline{XY}$, $\overline{YZ}$, $\overline{ZX}$. Answers will vary
12. the letters of the alphabet using only line segments

By following a straight path in Roger's home,

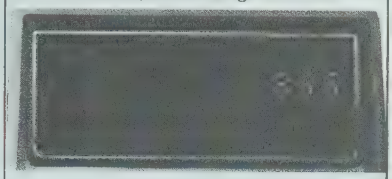
13. can Barky get to the dog dish (D)? yes
14. can anyone at the dining table see TV? Z
*15. can Barky get to the dog blanket (B)? Yes, if he goes under the table.

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Some machines show digits that suggest line segments.

0 1 2 3 4
5 6 7 8 9

1. How many line segments make up each digit?



Turn this numeral upside down.

3 1 5
3 1 5

2. What word do you SEE? see
3. What other digits show letters when turned upside down? 0, 1, 4, 7
4. Using digits like those above, show a numeral that gives a word when turned upside down. Answers will vary, for example, 710

Do these. Write each result using digits like those above. What word will show when each result is turned over?

5. 310 − 296 14, hi
6. 338 + 177 515, sis
7. 6019 − 1979 4040, oh oh

try this

77

RELATED ACTIVITIES

- Some students may wish to find how many line segments are drawn in printing their names as shown.

BEV SMITH

38 line segments

or

BEV SMITH

27 line segments

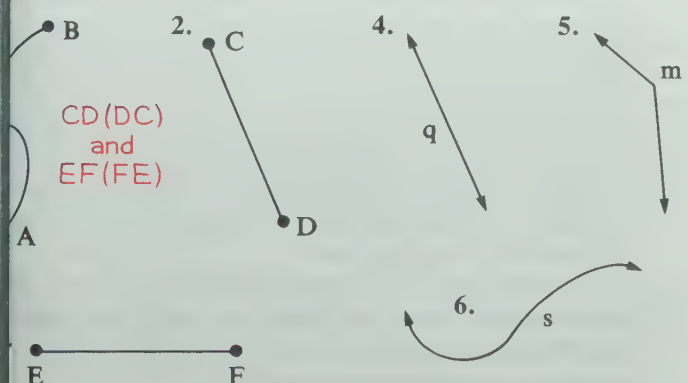
- Have students search for examples of line segments in their surroundings; for example, on ceilings, walls, floors, display boards, furniture, wallpaper designs, and fabric. This can be conducted in the form of the game "I Spy".

This: Students explore an application of line segments in this feature and observe an interesting relationship between letters of the alphabet and the ten digits formed using line segments.

sessment

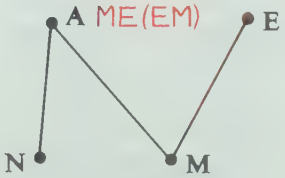
ich of these are e segments?

Which of these are lines? q



Name all the line segments shown.

7. AN(NA) AM(MA) ME(EM)

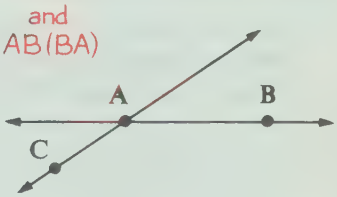


Draw and label these.

9. $\overleftrightarrow{AM}$ A M
10. $\overline{BE}$ B E

Name all the lines shown.

8. AC(CA) and AB(BA)



Pages 78-79

LESSON OUTCOME

Identify, name, and draw angles; classify angles as larger than, smaller than, or the same size as a right angle

Materials

two narrow strips of cardboard and a pronged paper fastener, straight edge and a square corner for each student, tracing paper (optional), demonstration clock

Vocabulary

angle, vertex, right angle

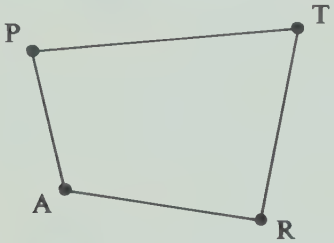
Prerequisite Skills

Identify and name line segments

Checking Prerequisite Skills

Name all the line segments shown.

1.



PA (AP)
AR (RA)
RT (TR)
PT (TP)

Angles

Parts of the lines suggested by the floor and staircase form an **angle**.

An angle can be named by naming its **vertex**.

vertex

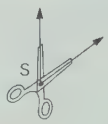
Angles that match square corners are **right angles**.

This right angle is angle P.

Working Together

Name the angles suggested by each picture.

1.



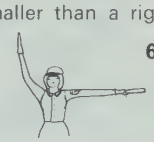
angle S

2.

angle L, angle M, angle N

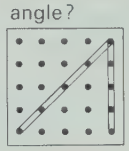
Which is larger and which is smaller than a right angle?

5.



larger than

6.

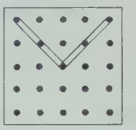


smaller than

Use a square corner. Test for right angles.

3. no

4.



yes

Draw and label these.

7. angle R

8. right angle S

9. an object that suggests an angle that is larger than a right angle

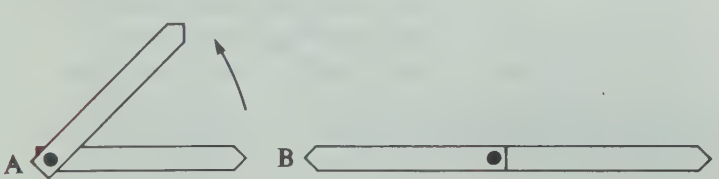
Answers will vary, for example, the hands of a clock at 9:10.

78

LESSON ACTIVITY

Before Using the Pages

- Prepare a model for demonstrating angles by joining two narrow strips of cardboard with a pronged paper fastener. This will allow the strips to move (A).



Say to the students, for example, "The edge of the chalkboard suggests a straight line." Position the strips along the edge of the chalkboard to demonstrate this (B). Have students suggest other straight lines and demonstrate with the strips. Then ask for examples of two lines meeting at a corner, and demonstrate with the strips; for example, the corner of the door or the corner of a triangular shape.

Using the Pages

- The photograph on page 78 can generate much discussi about where angles are seen in the everyday environmen Begin by introducing the term *angle*. Have the studen trace with their fingers the angle formed by the staircas and the wall. Have them suggest and trace other exampl of angles in the photograph. Then have them trace the ang shown beneath the photograph. Explain that since an ang is formed by parts of two lines, the arrowheads help show the parts that continue without end. (If you wis introduce the term *ray* for the part of a line which has o end point and continues without end in one direction.) It helpful to have the students trace the angle onto paper an then match it with the angle suggested by the staircase an the floor in the photograph. The arrowheads on the ang will become more significant.

  Discuss that an angle can be named by naming its *verte* with a capital letter. (At this time, only one angle considered at any vertex and thus, one letter is sufficient t determine the angle being named.)

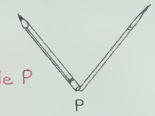
Exercises

Think about the things in your home.

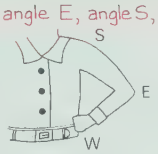
1. Make a list of objects that suggest angles. Answers will vary

How many angles are suggested by each picture? Name them. 3; angle E, angle S, angle W

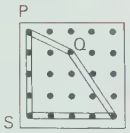
2. 1; angle P



3.



4. 4; angle P, angle Q, angle R, right angle S



Draw and label these.

5. angle L 6. right angle T 7. angle S smaller than a right angle

Make a list of objects Answers will vary for Ex. 8-10

8. that suggest right angles.
9. that suggest angles smaller than right angles.
10. that suggest angles larger than right angles.

Give one time when the hands on a clock
ssible answers are 3 o'clock and 9 o'clock. Possible answers are 4, 5, 6, 7, and 8 o'clock.

11. show a right angle. 12. show an angle larger than a right angle.

Use a toy clock to help you

*13. tell how many times in 12 h the hands on a clock show a right angle. 24

5.

6.

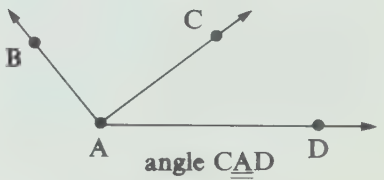
7.

RELATED ACTIVITIES

- Have students work with geoboards and colored rubber bands to show angles that are smaller than, larger than, and the same size as a right angle. The angles may also be shown on copies of page T 366.
- Have students write capital letters formed from line segments and mark the angles suggested by the letters, using dots as shown below.

- Students may use models similar to the one prepared in *Before Using the Pages* to investigate and compare angles suggested by objects in the classroom.
- Some students may ask how angles are named if they share a common vertex.

If possible, lead the students to suggest that naming another point on each arm of an angle would enable them to use three points to name each of the angles.



Point out that angles shaped like a square corner are found very often in everyday life and are given the special name *right angles*. Have students suggest examples of right angles in the photograph. They may use a square corner cut from a sheet of paper to help identify right angles. Ask questions such as,
"Is the angle suggested by the hand rail and one post larger than or smaller than a right angle?"

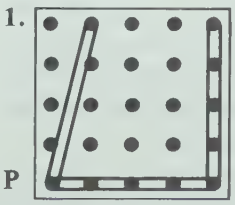
orking Together: Ex. 1 and 2 focus on naming an angle using the capital letter at its vertex. Establish that three angles are suggested in Ex. 2. Ex. 3-6 involve comparison of angles with a right angle. Each student will need a square corner. Ex. 7-9 deal with drawing and labeling angles. Have the students use their straight edges for these. Use other similar exercises as required.

ercises: The photograph on page 79 will help students answer Ex. 1 and Ex. 8-10. Ex. 13 will challenge some students. It would be helpful if the demonstration clock has an hour hand that is synchronized to move with the minute hand.

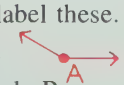
Assessment

Name the angles suggested by this picture.

1. angle P
angle M



Draw and label these. Answers will vary.

2. angle A 

3. right angle B

4. angle C smaller than a right angle

Give one time when the hands on a clock

5. show an angle smaller than a right angle.
Answers will vary. One time is 15:05.

Pages 80-81

LESSON OUTCOME

Identify and name triangles and their angles and sides; draw triangles

Materials

straight edge for each student

Vocabulary

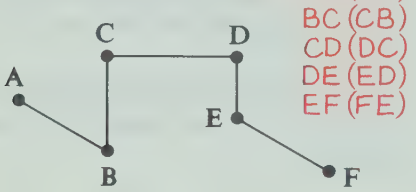
triangle, vertices, side

Prerequisite Skills

Name and draw line segments and angles

Checking Prerequisite Skills

For this picture, name

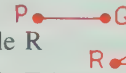


2. AB (BA)
BC (CB)
CD (DC)
DE (ED)
EF (FE)

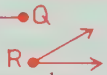
1. all the angles shown.
2. all the line segments shown.

Draw each of these.

3. $\overline{PQ}$ Answers will vary.

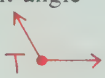


4. angle R



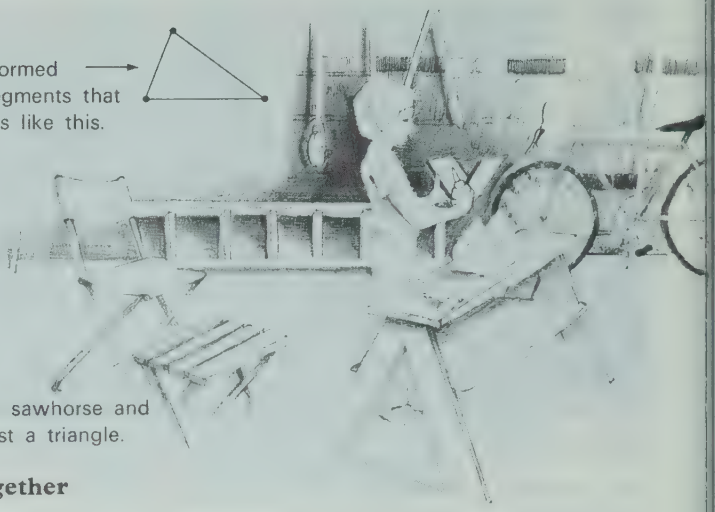
5. angle T larger than a right angle

1. angle ABC (CBA)
angle BCD (DCB)
angle CDE (EDC)
angle DEF (FED)



Triangles

A **triangle** is formed by three line segments that share end points like this.

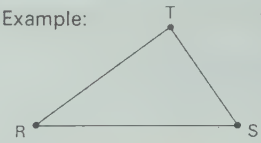


The legs of the sawhorse and the floor suggest a triangle.

Working Together

A triangle is named by naming its three **vertices** or corner points in any order.

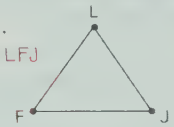
Example:



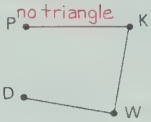
This is triangle RST. Another name for it is triangle SRT.

Name each triangle you see.

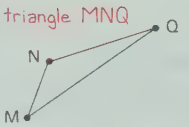
1. triangle LFJ



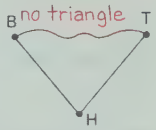
2. no triangle



3. triangle MNQ

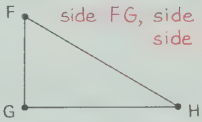


4. no triangle



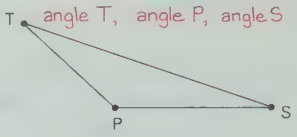
Each line segment in a triangle is a **side** of the triangle. Name the sides of this triangle.

5. side FG, side GH, side FH



The sides of a triangle suggest three angles. Name the three angles of this triangle.

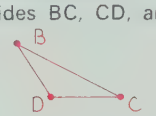
6. angle T, angle P, angle S



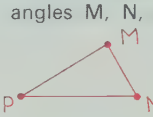
Draw and label these. Pictures will vary

7. triangle PQR

8. a triangle with sides BC, CD, and BD



9. a triangle with angles M, N, and P



LESSON ACTIVITY

Before Using the Pages

- Have a student use a straight edge to draw a line segment on the board. Have a second student draw a line segment so that it shares one end point with the first segment. Have a third student draw the segment that shares just one end point with the first segment and the other end point with the second segment.

Introduce the word *triangle* and discuss the number of line segments and the number of angles. You may wish to point out that "tri" means "three", and, therefore, the word *triangle* is a good name for the shape.

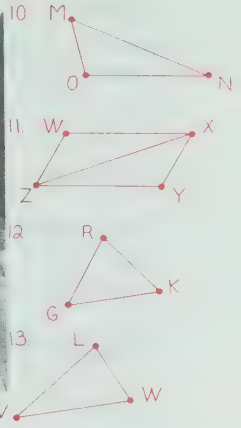
Using the Pages

- Read the description of a triangle and relate it to the previou procedure of drawing a triangle. Have the students use the fingers to trace the triangle suggested by the legs of th sawhorse and the floor. Have them identify and trace oth triangles suggested in the illustration.

Working Together: Draw the students' attention to the wor *vertices* and explain that it refers to more than one *verte* (They may compare the spelling of the words by referrin to page 78.) The example shows two ways of namin triangle RST. Have students suggest four more ways o naming the same triangle and write the names on the board

Ex. 1-4 deal with recognizing and naming triangles. It important to discuss why the shapes in Ex. 2 and 4 are n triangles.

Ex. 5 and 6 emphasize the parts of a triangle, introducin the term *side* for line segment. Ex. 7-9 involve drawing an labeling triangles. Have the students use their straight edge to draw the triangles.



Exercises

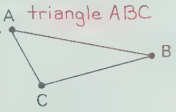
Think about things you find in a garage.

1. Make a list of objects that suggest triangles.

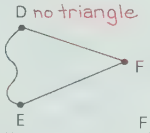
Answers will vary.

Name each triangle you see.

2. triangle ABC

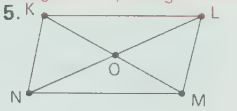


3. no triangle

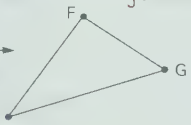


4. triangle GHJ
triangle HIJ

5. triangle KON, triangle LOM, triangle KOL, triangle NOM, triangle KNL, triangle LMN, triangle KLM, triangle MNK



Triangle FGH is one name for this triangle.
Triangle GHF is another name.



6. Write a third name.
7. Can you think of more names?

For triangle FGH, name

8. the sides.
9. the angles.

Draw and label these.

10. triangle MNO
11. triangle XYZ and triangle XWZ

The triangles share points X and Z.

12. a triangle with sides RG and GK
13. a triangle with angles L, V, and W

Pictures will vary for Ex 10-13. Examples are given above.

Find three straight objects.

14. Have a friend use them to suggest a triangle.

Answers will vary.

*15. Can this be done for any three straight objects that you give your friend? no

The combined lengths of two of the objects must be greater than the length of the third object.

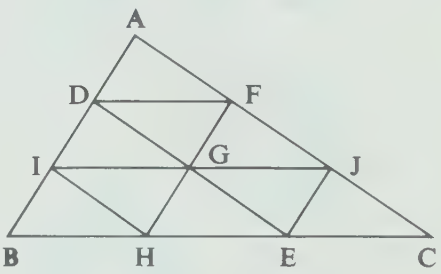
6. triangle HFG or triangle HGF
7. triangle GFH, triangle FHG
8. side FG, side GH, side HF
9. angle F, angle G, angle H

RELATED ACTIVITIES

- Students may make triangular shapes by joining drinking straws with pipe cleaners. The triangles may be suspended from the ceiling in mobiles to decorate the classroom.

  Cut a straw into two parts and demonstrate that these parts together with a third (whole) straw cannot form a triangle.
- Have students bring objects or pictures of objects to school that suggest triangles. Display these for several days.
- Have students create and color a design on copies of page T366 by joining points to form triangular shapes. You may wish to have them show the designs on a geoboard first.
- Some students may enjoy exercises similar to the following.

1. How many triangles do you see? Name them.



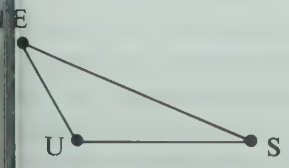
2. Can you draw a triangle that has one right angle? more than one right angle? three angles each less than a right angle?

ercises: The photograph on page 81 will help students answer Ex. 1. If students name just four triangles for Ex. 5, challenge them to find four more in the same diagram (triangles KNL, KLM, LMN, MNK). Have the students use straight edges for Ex. 10-13. Ex. 15 is important in that the answer is "No". Students can discover that the combined lengths of two sides of a triangle is greater than the length of the third side. Ensure that several examples are demonstrated for which a triangle cannot be formed; for example, a piece of chalk, a chalk brush, and a metre stick (see *Related Activities*).

sessment

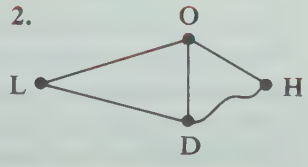
me each triangle you see.

Answers will vary.



triangle USE

2.

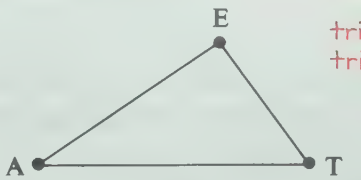


triangle OLD

Name the triangle two ways.

Answers will vary.

3.

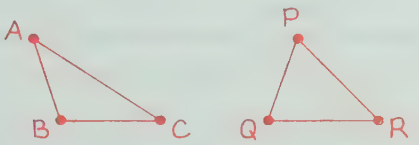


triangle EAT
triangle ATE

Draw and label these.

Answers will vary.

4. triangle ABC
5. a triangle with sides PQ and QR



Pages 82-83

LESSON OUTCOME

Identify and draw polygons; identify the angles and sides of polygons

Materials

straight edge for each student

Vocabulary

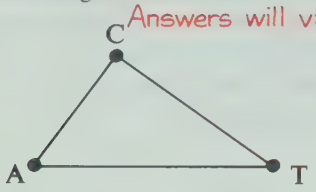
polygon, quadrilateral, pentagon, hexagon, octagon

Prerequisite Skills

Name the angles and sides of a triangle; draw a triangle

Checking Prerequisite Skills

For this triangle, name



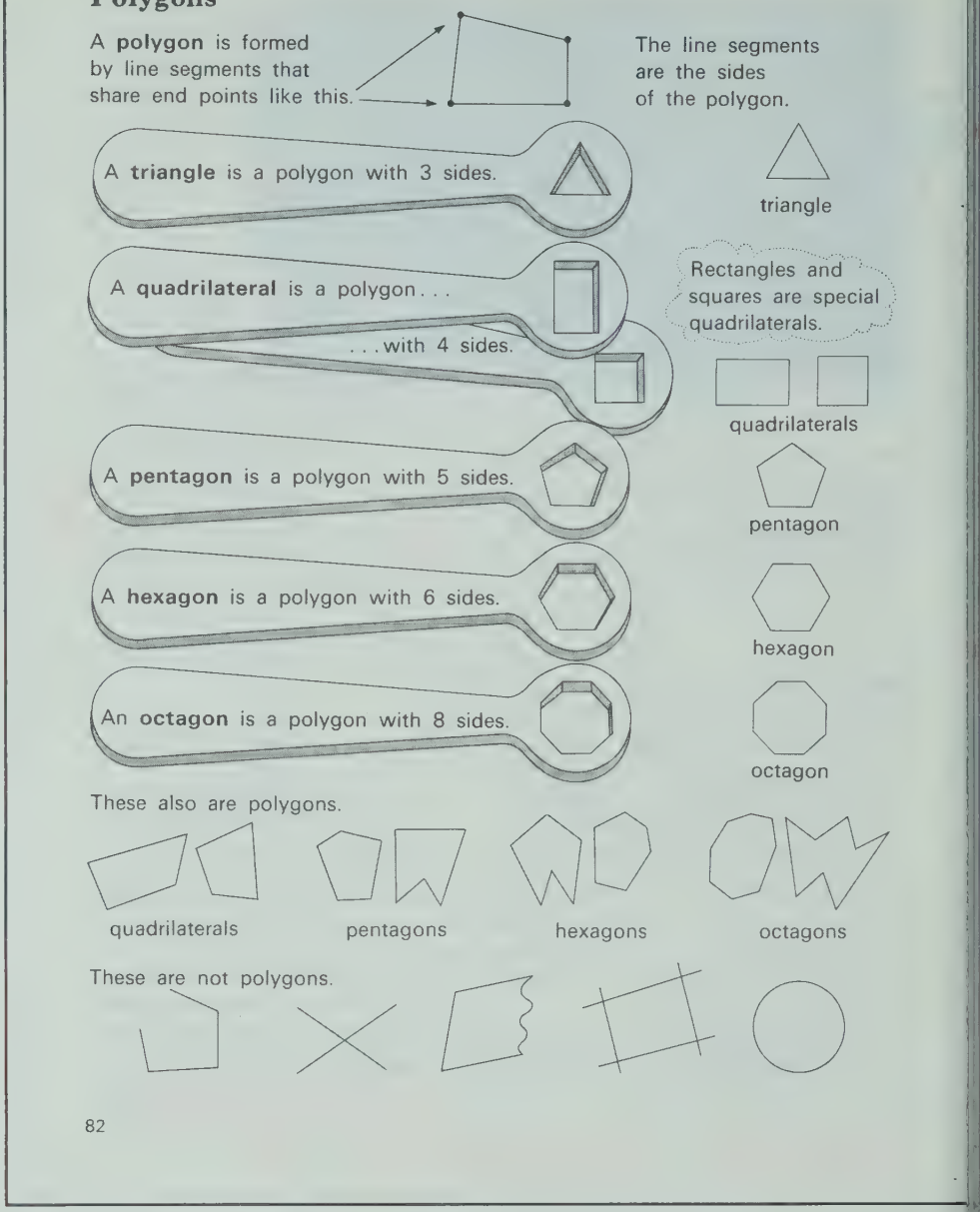
Answers will vary.

1. the angles. angle CAT, angle ATC, angle TCA
2. the sides. CA, AT, TC

Draw and label

3. triangle SHY.

Answers will vary.


Polygons
A polygon is formed by line segments that share end points like this.
The line segments are the sides of the polygon.
A triangle is a polygon with 3 sides.
triangle
A quadrilateral is a polygon . . .
. . . with 4 sides.
Rectangles and squares are special quadrilaterals.
quadrilaterals
A pentagon is a polygon with 5 sides.
pentagon
A hexagon is a polygon with 6 sides.
hexagon
An octagon is a polygon with 8 sides.
octagon
These also are polygons.
quadrilaterals
pentagons
hexagons
octagons
These are not polygons.
82

LESSON ACTIVITY

Before Using the Pages

- Review that a triangle is formed by three line segments that share end points. Thus, for a triangle, there are three sides and three angles. Ask questions such as,
  "If a shape has four sides, is it a triangle?"
  "If a shape has five angles, is it a triangle?"
  Have students name objects whose shapes suggest more than three sides; for example, the top of a desk, a stop sign.

Using the Pages

- The word *polygon* is introduced as a general term to describe shapes formed by line segments. Emphasize that end points of the segments are shared as illustrated at the top of the page.
  Ask questions such as, "What name is given to a polygon having five sides?" "How many sides does a polygon have if it is a hexagon?" Help the students with the pronunciation of names as needed. Pay particular attention to the term *quadrilateral*. All four-sided polygons a quadrilaterals. However, certain quadrilaterals are spec and are given special names, for example, square a rectangle.
  Draw the students' attention to the polygons illustrat near the bottom of page 82. Have them count the sides several shapes. Then have them study the shapes at t bottom of page 82 and suggest why these are not polygo In some cases the end points are not shared; in others t sides are not line segments.

Exercises: The students may refer to the names on page 82 assistance. Ex. 17 provides an opportunity to discuss tha polygon may have no fewer than three sides. Ex. 21 w provide a challenge. Some students may need to ha clarification of the problem first. Have them draw o triangle whose vertices are three vertices of the hexagon shown on page T89. Then ask them to find how ma different triangles they can draw in this manner. They m find it helpful to label the vertices and name the triangles they are drawn, to ensure that each is counted only onc

Exercises

Is it a polygon?
If so, give its name.

1. hexagon
2. quadrilateral
3. no
4. octagon
5. no
6. pentagon

How many angles are there for

7. a triangle? 3
8. a hexagon? 6
9. an octagon? 8
10. a pentagon? 5
11. this quadrilateral? 4

For quadrilateral ABCD above, name

12. the angles. angle A, angle B, angle C, angle D
13. the sides. side AB, side BC, side CD, side DA

Draw polygons that show these. If a picture is not possible, say so.

14. 5 sides
15. 3 angles
16. 7 sides
17. 2 sides

List two objects that suggest

18. triangles. Answers will vary
19. quadrilaterals.
20. hexagons.

Draw a hexagon. How many different triangles can you draw

*21. using three vertices of the hexagon as the vertices of each triangle? 13

14.
15.
16.
17. not possible

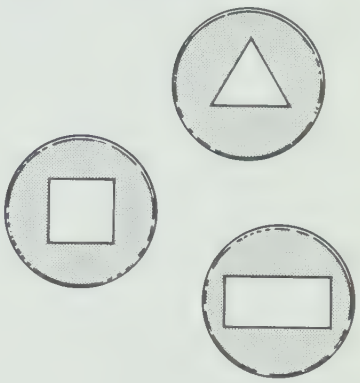
Add.

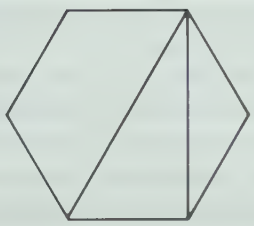
1.	31 14 45	2.	223 35 258	3.	$425 253 $678
4.	3570 108 3678	5.	3171 2327 5498	6.	$16.02 62.57 $78.59
7.	58 23 81	8.	52 52 104	9.	$472 184 $656
10.	905 434 1339	11.	7424 1419 8843	12.	$40.51 28.75 $69.26
13.	97 16 113	14.	546 59 605	15.	$623 639 $1262
16.	573 646 1219	17.	1392 378 1770	18.	$24.86 58.41 $83.27
19.	6348 2807 9155	20.	6872 176 7048	21.	$1159 2187 $3346
22.	984 87 1071	23.	987 355 1342	24.	$86.12 7.99 $94.11
25.	3568 4982 8550	26.	2677 493 3170	27.	$396 755 $1151
28.	3964 2836 6800	29.	4899 3929 8828	30.	$58.86 36.78 $95.64
31.	436 12 540 988	32.	63 285 3727 4075	33.	$1639 2525 $4164
34.	2493 1965 4572 9030	35.	$47.69 24.27 18.18 $90.14		

KEEPING SHARP

RELATED ACTIVITIES

- Have students use rubber bands to show the shapes of different polygons on a geoboard. Have them draw the shapes on copies of page T 366.
- Have students analyze the shapes from the preceding activity for line symmetry.
- If possible, have students bring wrenches to school similar to those illustrated on page 82 and provide an opportunity for each student to examine them. If possible, the nut that matches the shape for each wrench should also be displayed. Other objects suggesting these shapes may be brought as well (box tops, cookie cutters, and so on).
- Simple templates for polygons may be constructed from the plastic lids of such containers as margarine tubs and coffee cans. Draw the shapes on the lids and cut them out carefully with a sharp knife. Students may use the templates to draw shapes.





ping Sharp: These exercises help to maintain skills in addition. The skills are presented in the following organization of the exercises.

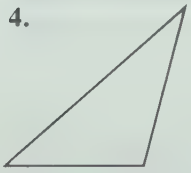
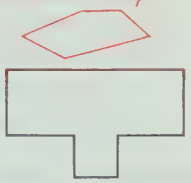
Ex. 1- 6 — no regrouping
Ex. 7-12 — one regrouping
Ex. 13-21 — two regroupings
Ex. 22-30 — three regroupings

Ex. 31-35 (except Ex. 33) involve three addends. All the exercises in the third column involve amounts of money. With this arrangement of exercises, you might consider assigning one column each day for three days.

Assessment

1. What is the name of a polygon having 6 sides? hexagon
2. How many line segments are needed to show a quadrilateral? 4
3. Draw a polygon that has 5 sides. Answers will vary.

Is it a polygon? If so, give its name.

4. 
triangle
5.
6. 
octagon

Pages 84-85

LESSON OUTCOME

Identify and draw circles; identify and name parts of a circle (centre, radius, diameter)

Materials

shapes cut from copies of pages T353-T356, a round object such as a coin for each student, a piece of string and a rubber band for each student

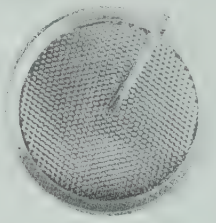
Vocabulary

circle, centre, radius, diameter

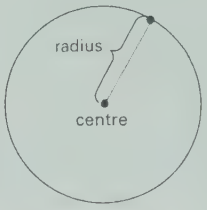
Circles

The cake pan has the shape of a **circle**. The blade is fastened to the pan at the **centre**. It suggests a **radius** of the circle.

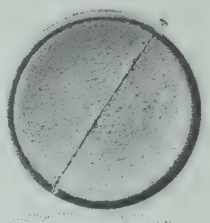
A **diameter** of a circle is a line segment that contains the centre and has end points on the circle.



cake pan



circle



This cake has been cut along a diameter.

A circle is a special curved path. All the points of a circle are the same distance from the centre. Here are some curved paths that are not circles.

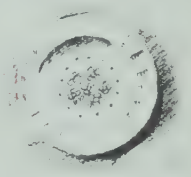
Working Together

Which objects suggest circles?

1. An end view of an egg suggests a circle.

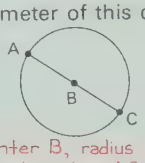
2. yes

3. yes



Name

4. the centre, a radius, and a diameter of this circle.

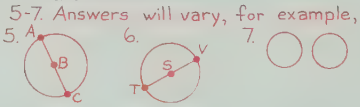


center B, radius AB or BC, diameter AC

Draw

5. a circle. Label its centre, a radius, and a diameter.
6. a circle with radius ST and diameter TV.
7. two circles that are the same size.

5-7. Answers will vary, for example,



LESSON ACTIVITY

Before Using the Pages

- Review that polygons are shapes whose sides are line segments that share end points. Display cutouts of the shapes from copies of pages T353-T356. Have students identify those which are quadrilaterals, pentagons, and so on. Ask which shape is not a polygon and have students suggest reasons.

Using the Pages

- Most students will likely be familiar with the term *circle*. However, the terms *radius*, *diameter*, and *centre* may be new to many. Have the students study the first illustration. Ask whether any of the students have seen a cake pan similar to the one shown. Establish that the circle is the curved path (not the interior region), that the centre is a point, and that a radius and a diameter are line segments. Discuss how each line segment is related to the circle. You may wish to draw a circle on the board and have seve students draw a radius and a diameter of the circle several different positions.

  Establish the special feature about a circle — all points are the same distance from the centre. Have stude give reasons to explain why the four curved pa illustrated are not circles.

Working Together: Have students identify the objects shown Ex. 1-3. You may have them answer the questions writing "Yes" or "No" for each exercise. Ex. 4 deals w recognizing and naming parts of a circle. Note that students may choose one of two radii, AB or BC. Ha them suggest other positions for a radius. Ask what poin always one of the end points of a radius. You will lik prefer to have the students use a device to help them dr their circles for Ex. 5-7. This may be a template, a rou object such as the lid of a jar, or compasses. Help them determine which letter, S, T, or V, must name the centre Ex. 6. Use other similar exercises as needed.

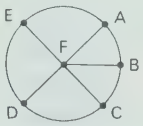
Exercises

Think about things you see in a kitchen.

1. Make a list of kitchen objects that suggest circles. Answers will vary

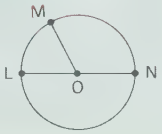
Name

2. the center.
3. each radius.
4. each diameter.



What is

5. $\overline{MO}$?
6. $\overline{LN}$?
7. O?
8. $\overline{OL}$?

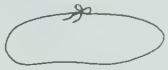


Can you draw a circle using something that is round, like a coin?

9. Try it.

10. What is special about all the circles that you draw using the same object? They are the same size.

Tie a string to make a loop.



Find a rubber band.

*11. Try to draw a circle using your pencil and the loop.

*12. Try to draw a circle using your pencil and the rubber band.

2. center F 3. radius FA, radius FB, radius FC, radius FD, radius FE
4. diameter DA, diameter EC 5. a radius
6. a diameter 7. the center 8. a radius

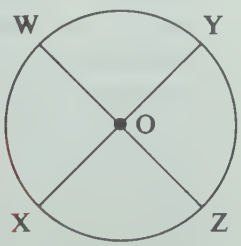
RELATED ACTIVITIES

- Have students trace around circular objects such as lids to create a design. The designs may be colored and displayed.
- Have students help to compile a list of objects that suggest the shape of a circle. Some of the objects may be brought to school and displayed for several days.

ercises: You may wish to have a brief discussion of the photograph on page 85 before the students begin Ex. 1. Provide each student with a piece of string and a rubber band for Ex. 11 and 12. Some students may try to form the loop of string into a circle and trace around it. Lead them to hold the loop taut with the pencil at one end and a finger at the other end. The end held by the pencil may move to trace the shape of a circle when the end held by a finger is kept still. In Ex. 12, students will experience that a rubber band allows the radius to change, and thus, it is not likely that a circle can be traced easily.

sessment

this diagram,



name the shape. a circle

name a radius. OW or OY or OZ or OX

name a diameter. WZ (ZW) or XY (YX)

ell what name is given to a point O. the center of the circle

Pages 86-87

LESSON OUTCOME

Trace a shape to determine whether it is congruent to another shape

Materials

tracing paper for each student

Vocabulary

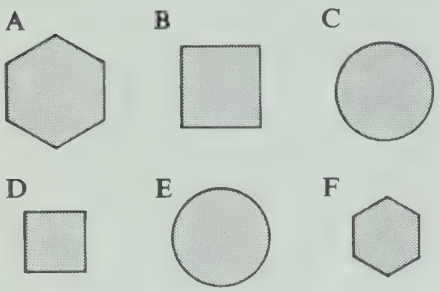
congruent, figure

Prerequisite Skills

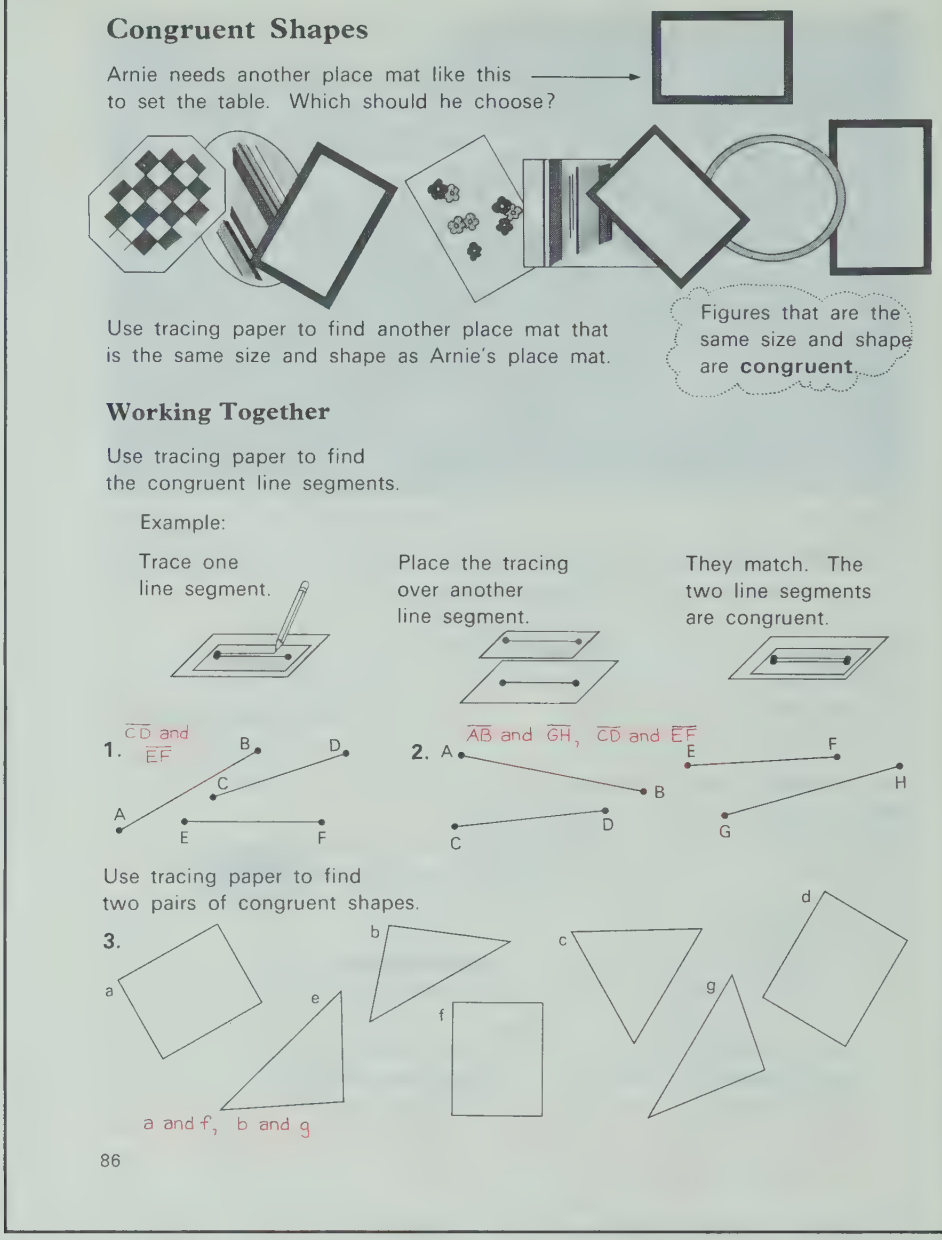
Recognize shapes that are similar

Checking Prerequisite Skills

1. Name three pairs of shapes that are similar.



A and F
B and D
C and E


Congruent Shapes
Arnie needs another place mat like this to set the table. Which should he choose?
Use tracing paper to find another place mat that is the same size and shape as Arnie's place mat.
Figures that are the same size and shape are congruent.
Working Together
Use tracing paper to find the congruent line segments.
Example:
Trace one line segment.
Place the tracing over another line segment.
They match. The two line segments are congruent.
1. CD and EF
2. AB and GH, CD and EF
Use tracing paper to find two pairs of congruent shapes.
3.
a and f, b and g
86

LESSON ACTIVITY

Using the Pages

- Begin with a discussion of the illustration. Ask how many place mats are shown and how many of these look alike. Introduce the problem situation described. Emphasize that Arnie needs a place mat that is the same shape *and* the same size as his own. Have the students trace Arnie's place mat and use it to find which of the three possible choices are acceptable. They may be surprised to find that two of the three place mats do not match the tracing. The third place mat from the left is the one that matches Arnie's place mat.

  Read the statement in the "thought cloud" to introduce the term *congruent*, and draw attention to the heading at the top of the page. Have students suggest other examples of figures that are congruent, such as sheets of paper, floor tiles, and records.

Working Together: Provide each student with sufficient traci paper to complete the exercises. These begin with li segments in Ex. 1 and 2 and lead to an investigation polygons in Ex. 3. Have each of several students read th answers aloud to practice terms introduced in this unit; f example, for Ex. 1,
"Line segment CD is congruent to line segment EF",
and for Ex. 3,
"Rectangle a is congruent to rectangle f".

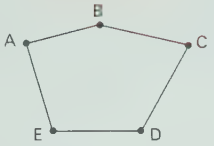
Exercises: Caution the students to make careful tracing particularly for Ex. 5-10. Ex. 9 and 10 can motivate discussion. For example, the "cookie" in Ex. 9 will fit hole in the dough if the "cookie" is flipped over. T rectangle in Ex. 10 appears as though it would fit t rectangular hole partially shown at the right of the dough

Exercises

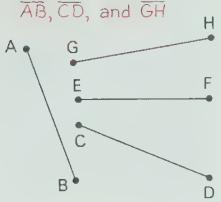
Use tracing paper to find the congruent line segments.

1. $\overline{AB}$ and $\overline{EF}$

2. $\overline{AE}$ and $\overline{BC}$

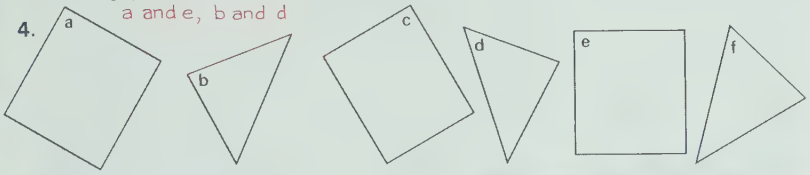


3. $\overline{AB}$, $\overline{CD}$, and $\overline{GH}$



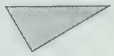
Use tracing paper to find the congruent shapes.

4. a and e, b and d



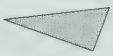
Use tracing paper to help you match each cookie with a hole in the dough.

5.

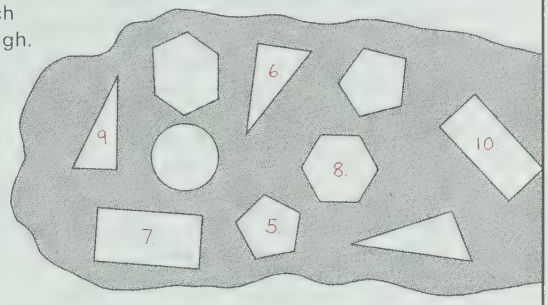
6. 

7.

8.

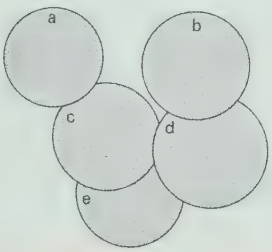
*9. 

*10.



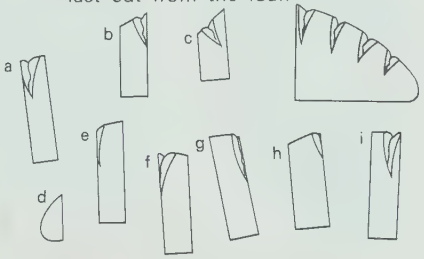
Use tracing paper to help you tell

11. which cookies came from the same cutter.



11. b, c, and e

12. which slice of bread was last cut from the loaf.



12. f

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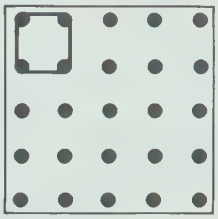
RELATED ACTIVITIES

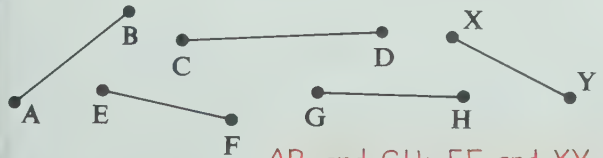
- Students may work in pairs using two geoboards and rubber bands. One student shows a shape on a geoboard. The other student tries to make a shape congruent to the shape on the other geoboard. The roles may be reversed after a time.
- You may wish to present students with exercises involving the geoboard, similar to the following.



"How many square shapes congruent to this one can you show on the geoboard?" 16

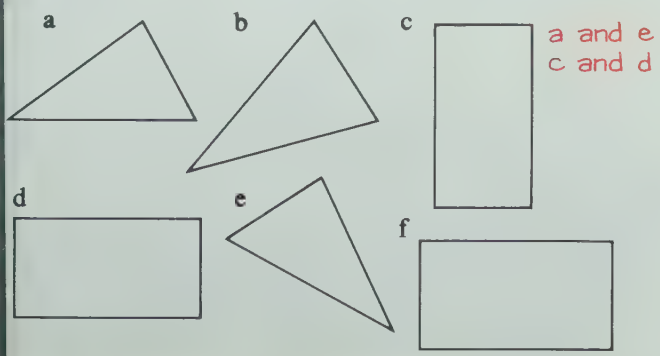
sessment

tracing paper to find the congruent line segments.



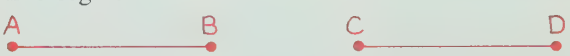
AB and GH; EF and XY

tracing paper to find the congruent shapes.



a and e
c and d

3. Draw a line segment AB.
Use tracing paper to draw a line segment CD congruent to line segment AB.



Pages 88-89

LESSON OUTCOME

Identify and count the vertices, edges, and faces of a solid; recognize two-dimensional patterns for solid shapes

Materials

a set of solid shapes including a hexagonal prism, patterns prepared from those on pages T357 and T358 for each student

Vocabulary

edge, face, solid

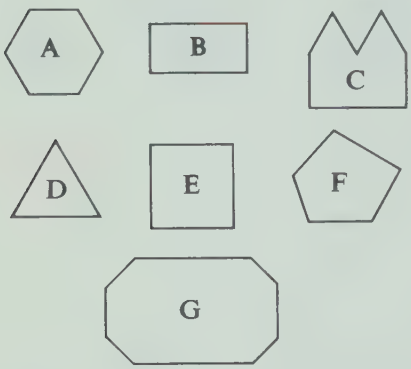
Prerequisite Skills

Identify polygons

Checking Prerequisite Skills

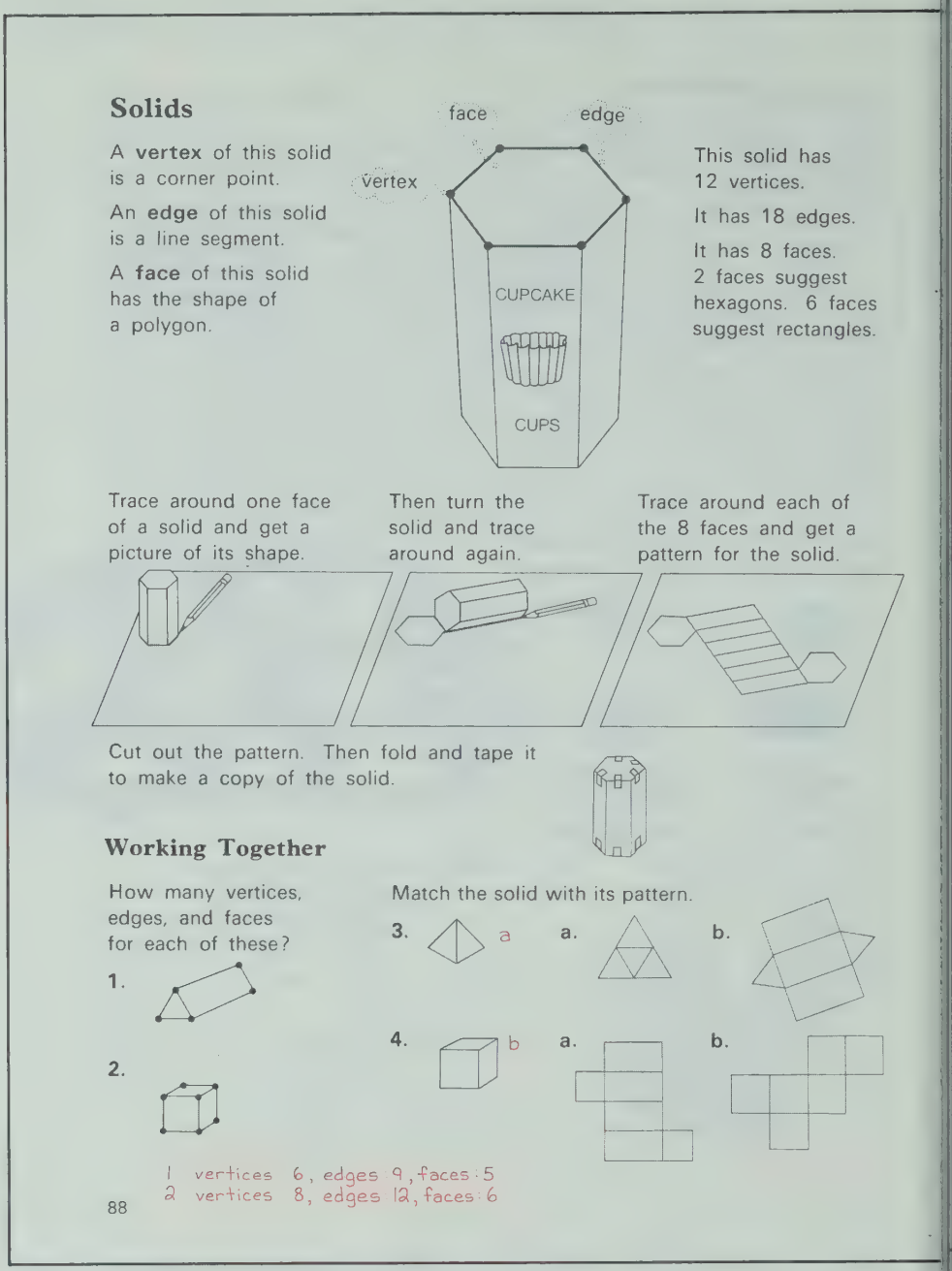
For the diagrams below, tell which shape is

1. a square E
2. a hexagon A
3. a triangle D
4. a pentagon F



How many sides has

5. a rectangle? 4
6. an octagon? 8


Solids
A vertex of this solid is a corner point.
An edge of this solid is a line segment.
A face of this solid has the shape of a polygon.
face
edge
vertex
CUPCAKE
CUPS
This solid has 12 vertices.
It has 18 edges.
It has 8 faces. 2 faces suggest hexagons. 6 faces suggest rectangles.
Trace around one face of a solid and get a picture of its shape.
Then turn the solid and trace around again.
Trace around each of the 8 faces and get a pattern for the solid.
Cut out the pattern. Then fold and tape it to make a copy of the solid.
Working Together
How many vertices, edges, and faces for each of these?
1.
2.
Match the solid with its pattern.
3. a
a.
b.
4. b
a.
b.
1 vertices 6, edges 9, faces 5
2 vertices 8, edges 12, faces 6
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LESSON ACTIVITY

Before Using the Pages

- Display a set of solids several days in advance of the lesson. Provide opportunities for the students to examine them and observe their likenesses and differences. Encourage them to share their observations with one another.

Using the Pages

- Have the students study the solid shape illustrated at the top of page 88. Have a student select the corresponding model from the solid shapes displayed in the classroom. Introduce each term named on the page, *vertex*, *edge*, and *face*, and have students point to these on the model. Have students help to count the vertices, faces, and edges of the model. If necessary, mark parts of the solid with chalk or bits of plasticine to help in counting. Compare the numbers with those given on the page. Discuss the shape of each face.
- Discuss the method shown for tracing the faces of a solid to obtain a pattern. Display the pattern prepared in advance for the hexagonal prism. Demonstrate that it can be fold to the shape of the hexagonal prism. Give each studen copy of the patterns on pages T 357 and T 358. Have the cut, fold, and tape the patterns to form models of solic The students may use these to help complete the exercise

Working Together: Ex. 1 and 2 deal with understanding t terms faces, edges, and vertices. Ex. 3 and 4 invol recognizing a two-dimensional pattern for a solid shap Use similar exercises for other shapes as needed. You m wish to have the students trace and fold the patterns for E 3 and 4, if they are unsure of the answer. Also, the stude may use the shapes prepared earlier from patterns assistance. However, it would be worthwhile to discu ways of matching each solid with its pattern without havi to trace and fold the pattern.

Exercises: Have the students use solid shapes, or those prepar earlier from patterns, to help with these exercises. On t basis of their charts, some students may be able determine the pattern of the numbers in Ex. 1-4. For eac the number of vertices added to the number of faces is equ

Exercises

Copy and complete the chart.

	Number of vertices	edges	faces
1.	8	12	6
2.	10	15	7
3. square on the bottom	5	8	5
4.	6	9	5

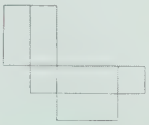
Describe the faces of each solid.

Example: 2 pentagons, 5 rectangles

5.
6.
7.
*8.

Match each solid with its pattern.

9. a
10. c
11. b

a.
b.
c. 
d.

Subtract.

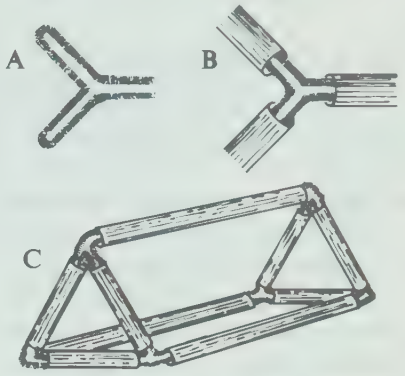
1. 59 − 34 = 25	2. 347 − 17 = 330	3. $586 − 213 = $373
4. 5756 − 302 = 5454	5. 8872 − 6151 = 2721	6. $84.89 − 32.07 = $52.82
7. 64 − 38 = 26	8. 527 − 92 = 435	9. $562 − 426 = $136
10. 506 − 184 = 322	11. 1298 − 547 = 751	12. $54.78 − 52.83 = $1.95
13. 712 − 39 = 673	14. 994 − 497 = 497	15. $1307 − 410 = $897
16. 7368 − 5792 = 1576	17. 3390 − 566 = 2824	18. $79.53 − 15.96 = $63.57
19. 1775 − 187 = 1588	20. 4115 − 3571 = 544	21. $8492 − 6685 = $1807
22. 1222 − 283 = 939	23. 8131 − 3276 = 4855	24. $45.81 − 8.95 = $36.86
25. 5640 − 2899 = 2741	26. 2221 − 534 = 1687	27. $7274 − 6976 = $298
28. 8444 − 4765 = 3679	29. 2215 − 1746 = 469	30. $82.12 − 48.24 = $33.88
31. 2503 − 358 = 2145	32. 7003 − 2214 = 4789	33. $4054 − 1393 = $2661
34. 5040 − 4857 = 183	35. $70.00 − 36.03 = $33.97	
36. $83.05 − 56.97 = $26.08		

KEEPING SHARP

5. 6 rectangles or 6 squares
7. 3 rectangles, 2 triangles
6. 2 hexagons, 6 rectangles
8. If the base is triangular, 4 triangles; if the base is square, 1 square and 4 triangles

RELATED ACTIVITIES

- Have the students construct the "skeleton" for a solid of their choice. Have them use drinking straws for edges and pipe cleaners to join the straws. Three straws may be joined at a vertex by bending one pipe cleaner in the following way.



- Encourage the students to bring to school objects, boxes, and so on, that resemble the shapes of the different solids.
- Print the names of the solids on pieces of paper. Tape each name to the appropriate solid for the set that is on display (see *Before Using the Pages*).

to the number of edges plus two (V + F = E + 2). For Ex. 5-8, encourage the use of the word *congruent* in a description of faces. For example, in Ex. 5, the faces are six congruent squares. Ex. 8 may have more than one answer because it is not obvious whether the base of the pyramid is triangular or square. Have students suggest how they were able to match solids and patterns in Ex. 9-11. For example, perhaps they recognized that for Ex. 9, each face is the shape of a square and there are six such faces.

ping Sharp: These exercises help to maintain skills in subtraction and are organized as follows.

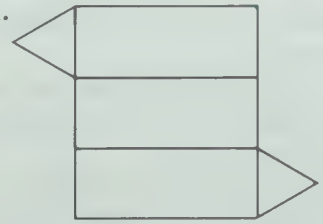
Ex. 1- 6 — no regrouping
Ex. 7-12 — no regrouping
Ex. 13-21 — two regroupings
Ex. 22-30 — three regroupings
Ex. 31-36 — 0 in one or more places of the minuend

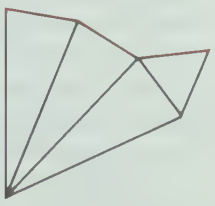
All the exercises in the third column involve amounts of money. If you do not wish to assign all the exercises at this time, the preceding description will help you decide which exercises may best suit the present needs of the students.

Assessment

For this solid,

1. give the number of vertices. 6
2. give the number of edges. 9
3. give the number of faces. 5
4. describe the faces. 3 congruent rectangles, 2 congruent triangles
5. identify its pattern. a

a. 

b. 

Page 90

OBJECTIVE

Organize information for solving a problem

Vocabulary

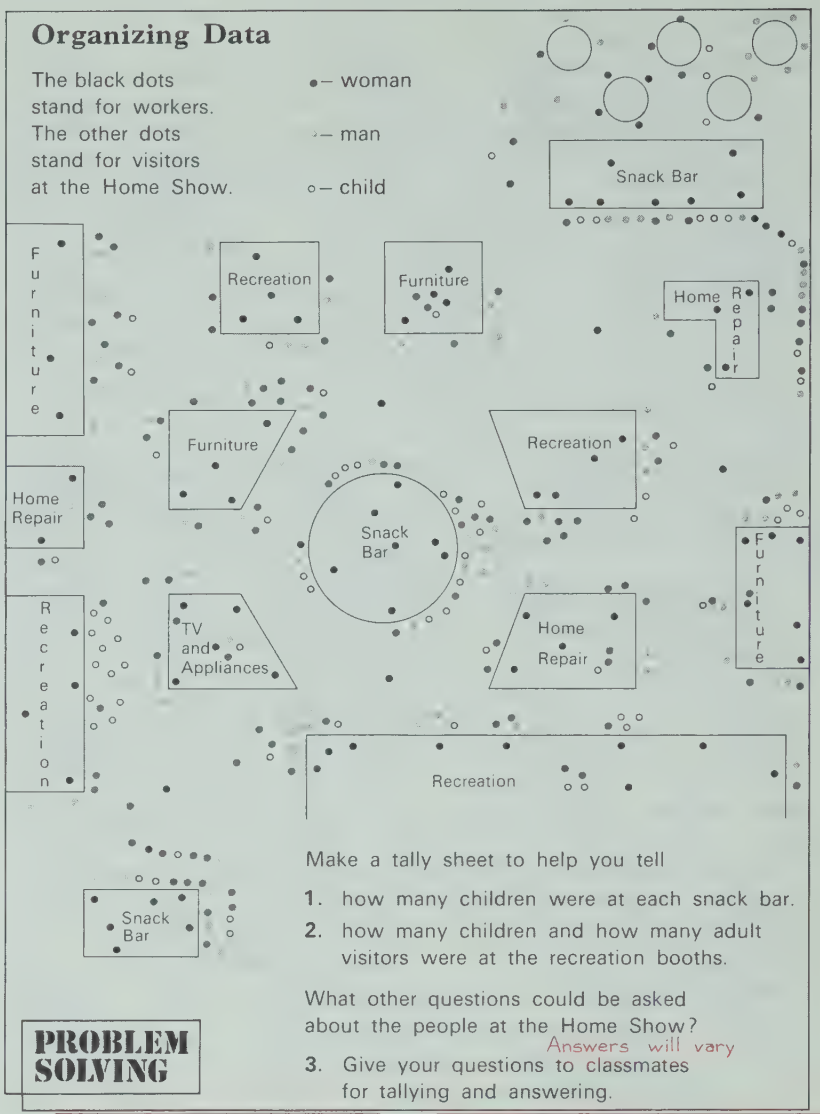
tally sheet

RELATED ACTIVITIES

- Some students may be interested in graphing information organized in their tally sheets for the situation on this page. Two topics are given below.

1. The number of workers and the number of visitors at each kind of booth (not at each booth).
2. The total numbers of workers, female adult visitors, male adult visitors, and children at the show.

- Have students select topics of interest to them and then gather the necessary information in the form of a tally sheet. Insist that the tally sheets be neatly presented.
- Have each student draw a picture to show the members of her/his family, using the same code for male adults, female adults, and children as on page 90. Have the students prepare tally sheets from the pictures for the number of each kind of family member.



90

1.

Snack bar	Number of children	Total
Top	𝍸 𝍸 II	12
Middle	𝍸 𝍸 III	13
Bottom	𝍸	5

2.

Recreation booth	Number of children	Number of adults	Total
Booth 1	I	𝍸 III	9
Booth 2	III	𝍸 𝍸 I	14
Booth 3	𝍸 𝍸 II	𝍸 IIII	21
Booth 4	𝍸 III	𝍸 𝍸 𝍸 I	29

LESSON ACTIVITY

Using the Page

- Begin with a brief discussion of exhibitions and fairs and the kinds of exhibits that are usually seen. Identify the plan on page 90 as the exhibits at a Home Show and have students name the booths shown. You might discuss the kinds of things that would be seen, for example, those at a Home Repair booth. Ask how many Snack Bars there are, how many Recreation booths there are, and so on. Establish what the different dots represent.

  Have a student read Ex. 1. Emphasize the need for an organized approach to the problem and have students suggest a way of drawing up a tally sheet.

Booth	Number of Children	Total
Snack Bar 1	𝍸 𝍸 II	12
Snack Bar 2		
Snack Bar 3		

Checking Up

From the list, choose the one idea that *best* matches each picture.

1. triangle
2. hexagon
3. line segment
4. circle
5. right angle
6. line
7. line symmetry
8. polygon
9. square faces
10. polygon
11. angle
12. triangle

line symmetry
line segment
line
angle
right angle
triangle
polygon
hexagon
circle
square faces

Name each of these.

13. line QP
14. angle S
15. line segment AB
16. radius CD
17. triangle JKL
18. diameter XY

Draw a picture for each of these.

Pictures will vary.

19. $\overleftrightarrow{XY}$
20. a circle with center C
21. a polygon with 5 sides
22. angle A
23. a circle with diameter AB
24. one face of this solid
25. a quadrilateral
26. a circle with radius PQ
27. a polygon showing 4 angles
28. a triangle with sides RS, TS, TR

Which line segments are congruent?

29. 29. $\overline{CD}$ and $\overline{EF}$

Which shapes are congruent?

30. 30. triangle ABC and triangle MNO

Page 91

OBJECTIVE

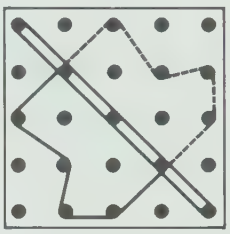
Demonstrate an understanding of the concepts and skills presented in this unit

Materials

tracing paper for each student

RELATED ACTIVITIES

- You may wish to provide additional activities involving line symmetry since this concept is not included in *Checking Up*. Students may work in pairs using a geoboard or geopaper. A rubber band is placed on the geoboard to represent a line of symmetry. One student thinks of a symmetric shape and shows only the part on one side of the line of symmetry. The other student must complete the shape by showing the part on the other side of the line of symmetry.



- Many students will enjoy discovering that line segments can form the shape of a curve, through the process of "curve stitching" as described on page T340.

ills	Exercises	Related Pages
entify, name, and draw lines and line segments	3,6,13,15,19	T82-T83
entify line-symmetric shapes	7	T80-T81
entify, name, and draw angles	5,11,14,22	T84-T85
entify, name, and draw triangles	1,12,17,28	T86-T87
entify and draw polygons	2,8,10, 21,25,27	T88-T89
entify and draw circles, radii, diameters, centers	4,16,18, 20,23,26	T90-T91
entify congruent shapes	29,30	T92-T93
entify and draw faces of a solid	9,24	T94-T95

Comments

Emphasize the word *best* in the instruction at the top of the page. For example, since the term *octagon* is not listed, the idea that best matches the picture in Ex. 8 is probably *polygon*. Every word in the list matches at least one picture.

Have the students use tracing paper to find which shapes are congruent in Ex. 29 and 30.

Pages 92-93

OBJECTIVE

Demonstrate competence in addition and subtraction skills; solve related word problems

Checking Skills

Add.

1. 45 + 24 = 69	2. 131 + 56 = 187	3. 452 + 102 = 554
4. 713 + 142 = 855	5. 3062 + 226 = 3288	6. 1541 + 52 = 1593
7. 2245 + 3122 = 5367	8. 1354 + 4333 = 5687	9. 3172 + 1725 = 4897
10. 17 + 34 = 51	11. 92 + 63 = 155	12. 251 + 658 = 909
13. 623 + 870 = 1493	14. 3613 + 318 = 3931	15. 6445 + 1493 = 7938
16. 2858 + 711 = 3569	17. 2306 + 4446 = 6752	18. 1843 + 5242 = 7085

Subtract.

19. 49 − 24 = 25	20. 387 − 36 = 351	21. 857 − 552 = 305
22. 124 − 114 = 10	23. 5678 − 337 = 5341	24. 4595 − 2461 = 2134
25. 2678 − 254 = 2424	26. 2743 − 2131 = 612	27. 9349 − 1208 = 8141
28. 84 − 38 = 46	29. 108 − 12 = 96	30. 993 − 765 = 228
31. 716 − 164 = 552	32. 1666 − 629 = 1037	33. 9079 − 1345 = 7734
34. 5725 − 4183 = 1542	35. 1146 − 512 = 634	36. 4656 − 3735 = 921

Add.

1. 94 + 17 = 111	2. 278 + 57 = 335	3. 249 + 458 = 707
4. 538 + 916 = 1454	5. 735 + 372 = 1107	6. 4537 + 739 = 5276
7. 3596 + 4107 = 7703	8. 4528 + 3653 = 8181	9. 2684 + 2581 = 5265
10. 927 + 97 = 1024	11. 978 + 224 = 1202	12. 1947 + 966 = 2913
13. 6926 + 589 = 7515	14. 3695 + 5638 = 9333	15. 2186 + 1854 = 4040
16. 3148 + 989 = 4137	17. 1609 + 3894 = 5503	18. 6973 + 1789 = 8762

Subtract.

19. 322 − 95 = 227	20. 742 − 383 = 359	21. 1609 − 652 = 957
22. 9842 − 3776 = 6066	23. 2391 − 453 = 1938	24. 5847 − 3972 = 1875
25. 3670 − 274 = 3396	26. 9119 − 3879 = 5240	27. 7281 − 4912 = 2369
28. 5134 − 949 = 4185	29. 8864 − 4895 = 3969	30. 6420 − 1582 = 4838
31. 4264 − 2686 = 1578	32. 1725 − 957 = 768	33. 4148 − 1769 = 2379
34. 1156 − 388 = 768	35. 5130 − 1671 = 3459	36. 3233 − 2489 = 744

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LESSON ACTIVITY

Using the Pages

- The exercises are presented in four sections so that, where possible, similar skills are dealt with in the two operations of addition and subtraction. The organization is as follows.

	Addition	Subtraction
Section 1 no regrouping one regrouping	 Ex. 1-9 Ex. 10-18	 Ex. 19-27 Ex. 28-36
Section 2 two regroupings three regroupings	 Ex. 1-9 Ex. 10-18	 Ex. 19-27 Ex. 28-36
Section 3 three addends minuends with zero amounts of money	 Ex. 1-6 — Ex. 7-15	 — Ex. 16-24 Ex. 25-33
Section 4 word problems	 Ex. 1, 3, 5, 8	 Ex. 2, 4, 6, 7, 9

- The exercises may be assigned over a period of time different ways, according to the needs of the studen Some suggestions are given below.
  1. Assign one section at a time so that skills in b operations are practiced together in increasing levels difficulty.
  2. Assign the first column from each section of exerci and two or three word problems. In this way, every sk is met each time and in increasing levels of difficult
  3. Assign only the addition exercises to review the sk with this operation. Then assign the subtraction ex cises. These may be followed by the word problems
- These exercises will help you to determine areas in wh students may need further practice or review. Adapt t lessons and activities on the appropriate pages. P particular attention to Ex. 16-24 on page 93 becau students often find exercises with minuends like the difficult.

Add.

1. 1349 26 502 1877	2. 1296 2202 797 4295	3. 907 336 2567 3810
4. 1872 1171 2958 6001	5. 3269 268 1686 5223	6. 2875 2668 2829 8372
7. $348 245 $593	8. $4397 830 $5227	9. $4955 2775 $7730
10. $21.96 5.62 $27.58	11. $12.67 63.37 $76.04	12. $18.84 29.29 $48.13
13. $10.25 1.79 0.43 $12.47	14. $ 6.38 25.26 23.56 $55.20	15. $33.97 17.48 12.59 $64.04

Subtract.

16. 900 468 432	17. 3038 572 2466	18. 7604 5256 2348
19. 1021 672 349	20. 6000 3926 2074	21. 2700 884 1816
22. 7040 1085 5955	23. 7305 2628 4677	24. 6001 5813 188
25. $482 237 $245	26. $3712 579 $3133	27. $9543 1946 $7597
28. $8.17 6.44 $1.73	29. $33.58 15.76 $17.82	30. $52.37 18.48 $33.89
31. $10.00 3.02 $ 6.98	32. $90.80 37.93 $52.87	33. $46.00 26.41 $19.59

Solve.

1. Roger said that in one year he left the house 1825 times by the front door and 1095 times by the back door. How many times is this in all? 2920
2. The box of thumb tacks showed that it held 550. Teri counted 89 tacks in the box. How many thumb tacks had been used from the box? 461
3. Sam's parents spent $1675 for a car and $369 for a trailer. How much did they spend in all? $2044
4. Rick said that he spent 517 h watching TV last year. Judy said that she spent 472 h. If they are correct, how many more hours did Rick watch TV? 45
5. Jim charged $1.85 for mowing and $2.25 for raking a lawn. How much did he charge in all? $4.10
6. Kay's parents drove 1014 km on a trip. The trip home was 886 km. How much less did they drive coming home? 128 km
7. Selby had saved $227 in her bank account. She used $118 for a new bicycle. How much did she have left? $109
8. One bag contained 675 nails. Another held 390 and a third had 288. How many nails were in the three bags? 1353
9. Rona received $30.00 on her birthday. She spent $22.75. How much did she not spend? $7.25

93

RELATED ACTIVITIES

- Have students make up their own addition and subtraction word problems. The problems can be written on index cards and the solutions can be shown on index cards of a different color. Have the students exchange problem cards.

To help students with ideas for writing word problems, provide them with such items as road maps that have charts showing distances in kilometres, and magazines and catalogs with prices of objects shown.

Unit 5 Overview

Multiplication

This unit begins with a review of basic multiplication facts for products to 45 and then proceeds to complete them for products to 81. Special attention is given to the numbers zero and one because they have special properties as factors. Arrays are used frequently and the relationship between multiplication and repeated addition is easily seen. Tables of factors and products in both horizontal and vertical arrangements are completed by the students and these, as well as the multiplication table in the textbook, provide easy references for the students. Work with missing factors in multiplication sentences is included to prepare for division in Unit 6.

Multiplication of ten and multiples of ten, and of one hundred and multiples of one hundred, leads to multiplication of two-digit and three-digit numbers. At first, separate products are obtained for each place value and are then added, but toward the end of the unit the shorter form of the algorithm with regrouping is developed. The use of parentheses is reviewed and exercises involving one or two of the operations addition, subtraction, and multiplication are included. The unit ends with realistic problems which require two or more steps for their solutions.

Prerequisite Skills

- add one-digit numbers
- express a multiple of ten as a number of tens
- express a multiple of one hundred as a number of hundreds
- add and subtract with regrouping
- write amounts of money to $9.99 as a number of cents and in dollars-and-cents notation

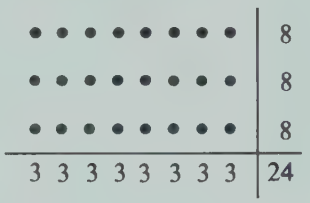
Unit Outcomes

- write two addition sentences and two multiplication sentences to describe a rectangular array
- complete basic multiplication facts, products to 81
- find the product when 0 or 1 is a factor
- use a multiplication table to complete basic multiplication facts
- determine the missing factor in a multiplication fact
- multiply a multiple of ten from 10 to 90 by a one-digit number
- multiply a two-digit number by a one-digit number
- multiply a multiple of one hundred from 100 to 900 by a one-digit number
- multiply a three-digit number by a one-digit number
- use the standard algorithm to multiply a three-digit number by a one-digit number
- multiply an amount of money to $9.99 by a one-digit number
- find the product of three or four one-digit numbers
- simplify a number expression involving more than one operation by first completing the operation shown in parentheses
- solve word problems by using multiplication
- solve word problems involving two or more steps

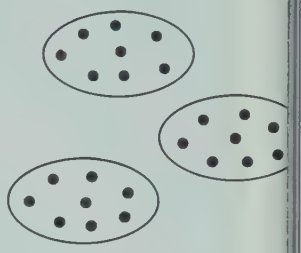
Background

Multiplication is a binary operation in which two numbers called *factors* are combined to produce a third number called their *product*. The product may also be considered a *multiple* of either of the two factors. For example, in $7 \times 4 = 28$, the factors are 7 and 4, and the product is 28. The number 28 is also a multiple of several numbers: 1, 2, 4, 7, 14, and 28; but, relation to this number sentence, it is obvious that 28 is multiple of 7 and also a multiple of 4.

Multiplication is related to addition: the sum of equal adden is the same as the product of the particular addend and t number of such addends. For example, in $3 \times 8 = 24$ a $8 + 8 + 8 = 24$, the product 24 is the same as the sum 2 Arrays are used extensively in this unit to illustrate multipli tion, although it may also be shown by groups and by jumps o number line.



3 rows, 8 columns



3 groups of 8

3 jumps of 8

The number sentence $3 \times 8 = 24$ is read "three times ei equals twenty-four" and relates to 3 sets of 8. The multiplier i and the multiplicand is 8. Note that the symbol $\times$ is not r "multiplied by" since this would indicate the opposite w respect to the number of groups and the size of each group. T array shown has 3 rows with 8 in each row. If the array is turn one-quarter turn, it shows 8 rows with 3 in each row, and related multiplication sentence is $8 \times 3 = 24$. Since they can turned so easily, arrays are effective aids to demonstrate *commutative property of multiplication*, which states that order of multiplying two numbers does not affect their produ The multiplication table as shown on page 100 may also be u to demonstrate the commutative property. The product of 6 3, for example, is seen twice — as the third multiple of 6 and the sixth multiple of 3; so 6×3 is equal to 3×6 because b equal 18.

Zero and one are given special attention as factors. multiplication the number one is known as the *identity eleme* that is, when 1 is one of two factors, the product is alw identical to the other factor. Zero is interesting because if factor is zero, the product is zero, regardless of the size of other factor or factors. A number line is useful in demonstrat the result when zero is a factor. For example, 2×0 can interpreted as 2 jumps, each 0 units in length, and no movem forward is made. Similarly, 0×3 can be interpreted as 0 jun each 3 units in length, and again no forward progress is ma Thus, the product of zero and any number is always zero.

A multiplication sentence which names two factors less th 10 and their product describes a *basic multiplication fact*, example, $6 \times 7 = 42$. Basic multiplication facts are u repeatedly in multiplication of two-digit and three-digit nu bers. Since multiplication is a binary operation, only one digi the multiplier and one digit of the multiplicand can be opera on at any one time. The place values of the digits must

ected so that their products are interpreted correctly and ed properly. Treating each place-value digit separately lts in two or more partial products which may then be added

Actually, this is possible because of the *distributive perty of multiplication over addition*. In the example shown, number 84 is 8 tens 4 ones (80 + 4), and both parts are tiplied by 6; that is, the factor 6 is distributed over the two s of the factor 84. Number sentences show this in another (B).

A

$$\begin{array}{r} 84 \\ \times\ 6 \\ \hline 24 \\ 480 \\ \hline 504 \end{array}$$

B

$$\begin{aligned} 6 \times 84 &= 6 \times (80 + 4) \\ &= (6 \times 80) + (6 \times 4) \\ &= 480 + 24 \\ &= 504 \end{aligned}$$

C

$$\begin{array}{r} {\scriptstyle 2} \\ 84 \\ \times\ 6 \\ \hline 504 \end{array}$$

he most efficient algorithm from the standpoint of space bines the multiplications and addition in one line, but this edure is also more difficult. The so-called ''carrying'' ires that a digit of the product be remembered while another iplication is performed; then, that digit is added to the new luct. It is usual for students to show the ''carried'' number ng their early experiences with this type of multiplication However, before the students reach the level of two-digit tipliers in Unit 10, it is preferable that they no longer rely on aid.

has been mentioned that multiplication and addition are ed operations. They both have commutative properties, by ch the order of two numbers does not alter the result of either ation. They also have associative properties. In Unit 2 the ents learned that three or more numbers can be added in any r and their sum is the same each time. Now, in this unit, learn that three or more numbers can be multiplied in any r and their product is the same each time. This is the *ciative property of multiplication*.

ach multiplication step with carrying involves the two ations of multiplication and addition. When several erent operations are found in numerical expressions, the r of procedure can be determined by the use of parentheses y following the rules for the order of operations (see the rview for Unit 3 on pages T54 and T55). Parentheses are in this unit to guide the students in simplifying expressions multiplication, addition, and subtraction.

ching Strategies

tudents need direct experiences for discovering, relearning, verifying basic multiplication facts. To do so they should access to counters, pegs and pegboards, and number lines. cartons are suitable containers for setting out groups of nters; pegboards can be used to make arrays; number lines to or 100) can highlight those numbers which are multiples of a cular number. In working with these devices, particularly rectangular arrays, it is recommended that students treat facts in pairs whenever the two factors are different. Two facts may be learned together, for example, $6 \times 3 = 18$ and $3 \times 6 = 18$, and the recall of one will help the recall of the other. It should be pointed out, however, that although the two factors and their product are the same in both cases, their meanings in various contexts are usually different. For instance, 6 skipping ropes each 3 m long require exactly the same amount of rope as 3 skipping ropes each 6 m long; the two products are the same, but the number of ropes (multiplier) and their length (multiplicand) are different.

According to their knowledge of basic multiplication facts with products to 45 and their successes in learning the facts with products to 81, it may be necessary to group the students for the latter part of the unit where these facts are used and reused. Some students may derive benefit and pleasure in ''proving'' multiplication facts in several ways. One can use addition of lesser products to verify the accuracy of greater products. For example, to show $6 \times 8 = 48$, multiples of 8 can be added in a variety of ways.

$$\begin{array}{l} 5 \times 8 = 40 \\ \underline{1 \times 8 = \ \ 8} \\ 6 \times 8 = 48 \end{array}$$

$$\begin{array}{l} 3 \times 8 = 24 \\ \underline{3 \times 8 = 24} \\ 6 \times 8 = 48 \end{array}$$

$$\begin{array}{l} 4 \times 8 = 32 \\ \underline{2 \times 8 = 16} \\ 6 \times 8 = 48 \end{array}$$

$$\begin{array}{l} 2 \times 8 = 16 \\ 2 \times 8 = 16 \\ \underline{2 \times 8 = 16} \\ 6 \times 8 = 48 \end{array}$$

Place value cannot be overemphasized in all operations with numbers, including multiplication. In the early work of multiplying two-digit and three-digit numbers, the place value of each digit in the multiplicand should be emphasized. For example, in 4×312, the steps are 4×2 ones, 4×1 ten, and 4×3 hundreds. This becomes more significant when the students try to estimate products in Unit 10. Thinking of the 3 as hundreds provides a mental set for interpreting the product as hundreds, and an estimated product of 1200 is easily obtained for 4×312. Place value should be emphasized at all times to ensure meaningful development of the operation.

Materials

counters or a set of elevator beads (see page T 344) for each student
two sheets of paper or two cards about 12 cm long for each student
models for hundreds, tens, and ones

Vocabulary

array	operation
row, column	addition sentence
multiply	multiplication sentence
product, factor	multiplication table
multiple	missing factor

Pages 94-95

LESSON OUTCOME

Write two addition sentences and two multiplication sentences to describe a rectangular array; complete basic multiplication facts, products to 45

Materials

counters or a set of elevator beads (see page T 344) for each student

Vocabulary

array, multiply, addition sentence, multiplication sentence, row, column

Prerequisite Skills

Add one-digit numbers

Checking Prerequisite Skills

Add.

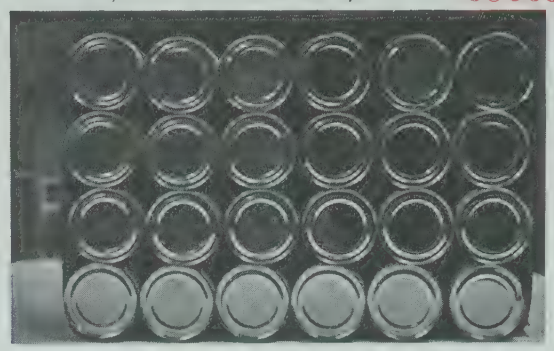
1. 4 + 4 + 4 + 4 + 4 20
2. 8 + 8 + 8 24
3. 5 + 5 + 5 + 5 + 5 + 5 30
4. 3 + 3 + 3 + 3 12
5. 6 + 6 12

8. 4+4+4+4+4=20
   5+5+5+5=20
   5×4=20
   4×5=20

9. 2+2+2=6
   3+3=6
   3×2=6
   2×3=6

10. 5+5+5+5+5+5=30
    6+6+6+6+6=30
    6×5=30
    5×6=30

11. 3+3+3+3+3=
    5×3=15



5 MULTIPLICATION

Basic Facts, One Factor to 5

How many cans are in this **array**?

Add, or count, 4 sixes.

6, 12, 18, 24

Add, or count, 6 fours.

4 + 4 + 4 + 4 + 4 + 4 = 24

4, 8, 12, 16, 20, 24

There are 24 cans in this array.

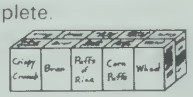
Multiply.

6 × 4 = 24

4 × 6 = 24

Working Together

Complete.



1. 2 + 2 + 2 + 2 + 2 = 10
   5 × 2 = 10

2. 3 + 3 + 3 + 3 = 12
   4 × 3 = 12

3. 6 + 6 + 6 = 18
   3 × 6 = 18

4. 1 + 1 + 1 + 1 + 1 + 1 = 6
   6 × 1 = 6

Give two addition sentences and two multiplication sentences for each array.

5. 5 + 5 + 5 = 15
   3 + 3 + 3 + 3 + 3 = 15
   3 × 5 = 15
   5 × 3 = 15

6. 6 + 6 + 6 + 6 = 24
   4 + 4 + 4 + 4 + 4 + 4 = 24
   4 × 6 = 24
   6 × 4 = 24

7. 4 + 4 = 8
   2 + 2 + 2 + 2 = 8
   2 × 4 = 8
   4 × 2 = 8

LESSON ACTIVITY

Before Using the Pages

- Review the concept of forming equal groups with the students. Have them use counters or elevator beads to show, for example, 3 groups of 4, 6 groups of 5, and 4 groups of 8. For each example, have them name the number in all. (Products should not be greater than 45.)

Using the Pages

- The worked example relates the concept of multiplication to the rectangular array and to repeated addition. For the 4-by-6 array of cans shown, two addition sentences and two multiplication sentences are given. Thus, the commutative (order) property of multiplication is also illustrated although it is not formally dealt with until later in this unit.

  Discuss that counting by ones is a slow way of determining the number of cans in all. Have students suggest more efficient ways of counting. Relate the addition of 4 sixes to the multiplication 4 × 6 in vertical and horizontal forms. Relate the addition of 6 fours to multiplication 6 × 4 shown two ways. Identify the sym × and review that it is read *times*. Point out the w *multiplication* at the top of page 94 and emphasize tha multiplication sentence is an efficient way of represent repeated addition. The term *array* should be reviewed as organized arrangement of objects in rows and colum Contrast the organized arrangement of the cans as sho with the haphazard display that would result from upsett the carton.

Working Together: Ex. 1-4 review the relationship betw repeated addition and the corresponding multiplication. assistance in completing the sentences, pictures provided in Ex. 1 and 2. It would be beneficial to ha several students read the completed sentences aloud.

Ex. 5-7 deal with the skill of writing two addit sentences and two multiplication sentences to describe array. Students having difficulty with these will find helpful to refer to the worked example at the top of page. Note that no square arrays are shown at this ti

1+1+1+1+1+1+1+1=8
8×1=8

13. 3+3+3=9
3×3=9

Draw arrays to match each of these. Give two addition sentences and two multiplication sentences to match each array.

	8.	9.	10.
rows	5	3	6
columns	4	2	5

Draw an array and write an addition sentence for each of these. Then complete each multiplication.

11. 5 × 3 **12.** 8 × 1 **13.** 3 × 3

Multiply.

14. 3 × 7 = 21 **15.** 4 × 1 = 4 **16.** 4 × 4 = 16

Exercises

Write two addition sentences and two multiplication sentences for each of these.

1. 6+6+6+6+6=30
5+5+5+5+5+5=30
5×6=30
6×5=30

2.

3. 5+5+5+5+5+5+5=35
7+7+7+7+7=35
7×5=35
5×7=35

4.

2. 8+8+8=24
3+3+3+3+3+3+3+3=24
3×8=24
8×3=24

4. 8+8=16
2+2+2+2+2+2+2+2=16
2×8=16
8×2=16

Write a multiplication sentence to answer each question.

5. 4 rows of red boxes. 3 in each row. How many boxes? 4×3=12
6. 2 stacks of gold boxes. 3 in each stack. How many boxes? 2×3=6
7. 5 rows of yellow boxes. 5 in each row. How many boxes? 5×5=25

Multiply.

8. 4 × 5 = 20 **9.** 9 × 2 = 18 **10.** 5 × 8 = 40
11. 3 × 9 = 27 **12.** 5 × 7 = 35 **13.** 6 × 3 = 18
14. 7 × 4 = 28 **15.** 8 × 5 = 40 **16.** 5 × 5 = 25
17. 8 × 3 = 24 **18.** 5 × 1 = 5 **19.** 4 × 7 = 28

20. 3 × 2 = 6 **21.** 9 × 4 = 36 **22.** 2 × 6 = 12 **23.** 2 × 2 = 4

24. 2 × 7 = 14 **25.** 9 × 1 = 9 **26.** 5 × 9 = 45 **27.** 4 × 3 = 12

RELATED ACTIVITIES

- Provide students with a 5-by-5 array and ask whether two multiplication sentences are possible for the array. Then have them draw three other arrays such that only one multiplication sentence is possible for each. Have the students write the multiplication sentence for each. Discuss the similarity of the arrays. (All the arrays are square.)
- Students may cut pictures of arrays from magazines and catalogs for a classroom display entitled, "Where have you seen an array today?" Multiplication sentences may be written for the arrays displayed. A list may be kept of arrays the students have noticed around the home, the school, the supermarket, and so on.

since the two multiplication sentences would be identical (see *Related Activities*).

It may be advisable to work Ex. 8 with the students to clarify the meanings of *row* and *column*. For each of Ex. 5-7, ask, "How many rows are there?" and "How many columns are there?" Then have students help to show dots on the board for an array having 5 rows and 4 columns (Ex. 8). This procedure will help them in drawing arrays for Ex. 11-13. For Ex. 11 and 12, two arrays are possible. For example, for Ex. 11, a student may choose either 5 rows of 3 or 5 columns of 3. However, for Ex. 13, 3 rows of 3 is the same as 3 columns of 3, which means the array is square.

For Ex. 14-16, the students may think of multiplication in more abstract terms, if they are able, but if a model is still required, arrays may be drawn.

rcises: Ex. 5-7 refer to the photograph directly above the exercises. Students are provided with another everyday example of an array and may use the illustrations as needed for assistance. Some students may need to draw arrays for Ex. 8-27.

Assessment

Write two addition sentences and two multiplication sentences.

1. 7+7+7=21
3×7=21
3+3+3+3+3+3+3=21
7×3=21

Multiply.

2. 4 × 5 = 20
3. 3 × 6 = 18
4. 9 × 2 = 18
5. 4 × 8 = 32

LESSON OUTCOME

Complete basic multiplication facts, products to 81; find the product when 0 or 1 is a factor

Materials

two sheets of paper or two cards about 12 cm long for each student

Vocabulary

product, factor

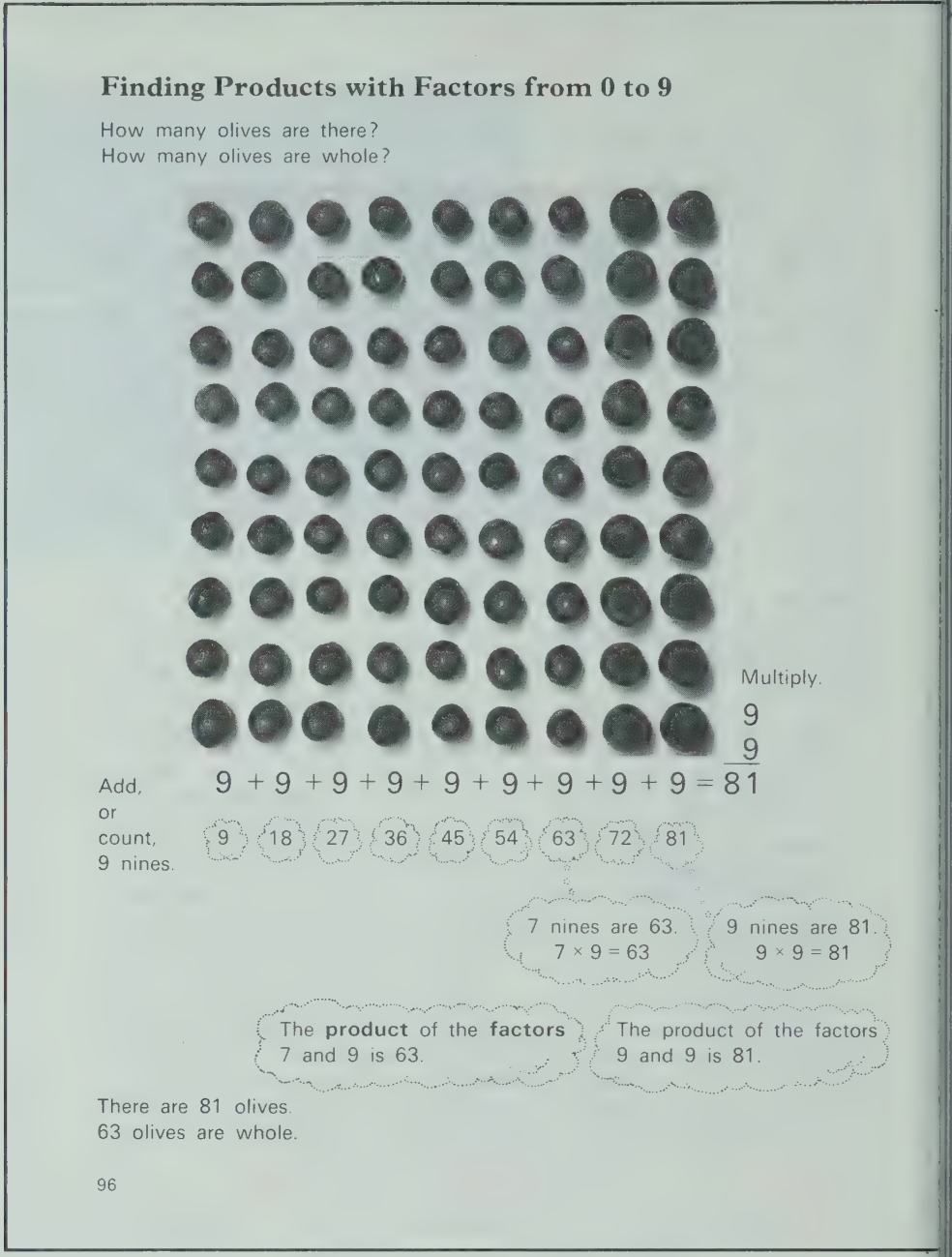
Prerequisite Skills

Add one-digit numbers

Checking Prerequisite Skills

Complete.

1. $9 + 9 + 9 + 9 + 9 + 9 = \underline{54}$
2. $6 + 6 + 6 + 6 + 6 + 6 + 6 + 6 + 6 = \underline{48}$
3. $8 + 8 + 8 + 8 + 8 + 8 + 8 + 8 = \underline{56}$
4. $7 + 7 + 7 + 7 + 7 + 7 + 7 + 7 = \underline{49}$


Finding Products with Factors from 0 to 9
How many olives are there?
How many olives are whole?
Multiply.
9
9
Add, or count, 9 nines.
9 + 9 + 9 + 9 + 9 + 9 + 9 + 9 + 9 = 81
9 18 27 36 45 54 63 72 81
7 nines are 63.
7 × 9 = 63
9 nines are 81.
9 × 9 = 81
The product of the factors 7 and 9 is 63.
The product of the factors 9 and 9 is 81.
There are 81 olives.
63 olives are whole.
96

LESSON ACTIVITY

Using the Pages

- Begin by discussing that there are many more objects in the array on page 96 than there are in the arrays on pages 94 and 95. Then have students suggest different ways of finding the number of olives in all (counting by ones, counting the olives in each row and adding, counting the olives in each column and adding, using multiplication). Point out that adding nines takes considerable time and explain that it is much more efficient to memorize the number in all for nine groups of nine (9×9).

  Discuss the difference in meaning between a "whole olive" and a "stuffed olive". Ask how many rows have whole olives and how many are in each row (9 rows of 7). Develop the multiplication sentence $9 \times 7 = 63$. Contrast this with the sentence $7 \times 9 = 63$ on page 96. Have the students turn their books one-quarter turn to see 7 rows of 9. Have them turn their books to the original position to see 7 columns of 9.

  Point out the words *factors* and *product*. Discuss that t number of columns and the number of rows in an arr name the factors. The product names the total number objects in the array.

  Ask how many rows and how many columns of stuff olives there are and how many stuffed olives there are all. Have students write the multiplication sentence on t board and identify the factors and the product. Af reading the concluding statements at the bottom of page 9 you may wish to illustrate the following relationships on t board.

$9 \times 9 = 81$	81 olives in all
$7 \times 9 = 63$	63 olives are whole
	$81 - 63$
$2 \times 9 = 18$	18 olives are stuffed

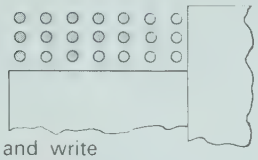
Working Together: Provide each student with two strips paper or two cards with which to cover parts of the array olives. Have them study the example at the top of page 9

Working Together

Give two addition sentences and two multiplication sentences for each of these. Cover parts of the array of olives with paper to help you if needed.

1. the product of 3 and 7
2. the product of 8 and 6

Example: For the product of 3 and 7, cover the olives like this,



and write

$3+3+3+3+3+3+3=21$

$7+7+7=21$

$7\times3=21$

$3\times7=21$

Find each product. Use paper on the array of olives to help you if needed.

3. 9×7 63
4. 7×1 7

5. 9 × 8 = 72
6. 6 × 7 = 42
7. 0 × 5 = 0 — 0 in each row . . . 0 in all.
8. 4 × 0 = 0 — 0 rows . . . 0 in all.

Exercises

Find each product. Cover parts of the array of olives with paper to help you if needed.

1. 6×8 48	2. 4×4 16	3. 3×6 18	4. 6×6 36	5. 4×3 12
6. 9×6 54	7. 8×8 64	8. 7×5 35	9. 4×7 28	10. 5×8 40
11. 4×6 24	12. 7×8 56	13. 5×9 45	14. 7×7 49	15. 9×7 63

Follow steps A and B, then complete the sentences.

A. Draw 3 rows of dots.
B. Show 1 dot in each row.

16. ⋮ dots are shown. ⋮, 3
17. $3\times1=$ 3

A. Draw 7 dots in each row.
B. Show 1 row.

18. ●●●●●●● dots are shown. ●●●●●●●, 7
19. $1\times7=$ ▯ 7

20. Give a rule for multiplying when 1 is a factor.
When multiplying with 1 as a factor, the product is the other factor.

A. Draw 6 rows of dots.
B. Show 0 dots in each row.

21. dots are shown. 0
22. $6\times0=$ 0

A. Draw 8 dots in each row.
B. Show 0 rows.

23. dots are shown. 0
24. $0\times8=$ 0

25. Give a rule for multiplying when 0 is a factor. When multiplying with 0 as a factor, the product is 0

97

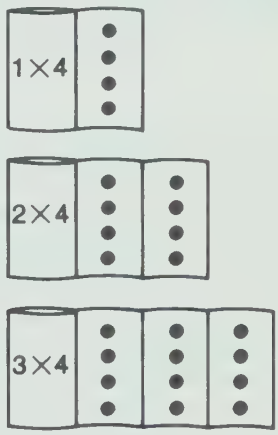
(Working Together)
2 $8+8+8+8+8+8=48$
$6+6+6+6+6+6+6+6=48$
$6\times8=48$
$8\times6=48$

RELATED ACTIVITIES

- To reinforce zero as a factor, have students ring those exercises for which the product is zero in a work sheet similar to the following.

4×0	1×5
6×3	1×0
1×4	4×4
0×8	0×6

- A device similar to the following can help students with basic multiplication facts. Have them fold a narrow strip of paper (about 8 cm by 40 cm) over about 4 cm at the left end and continue to fold over and over to the end of the strip. Have them unfold the strip gradually and mark it as illustrated below to show 4 as a factor. When completely unfolded, an array for 9×4 will be displayed. Similar strips may be prepared for other factors.



and then use their own strips in a similar manner on the array of olives to show a 3-by-7 array. Discuss that adding threes emphasizes the number of olives in each column. Ask what is emphasized by adding sevens. Draw out the relationship between each addition sentence and the corresponding multiplication sentence.

Ex. 4 provides an opportunity to discuss 1 as a factor. Similarly, Ex. 7 and 8 can motivate a discussion of 0 as a factor. These are dealt with in greater detail in *Exercises*. At this time, the "thought clouds" help to develop that if 0 is one of the two factors, the product will be 0, no matter what the other factor is. Use other similar examples as needed.

ercises: Encourage the students to answer Ex. 1-15 without using the array, if possible. When they have completed Ex. 16-24, discuss the role of 0 and 1 as factors. You may wish to have the students answer Ex. 20 and 25 orally rather than in writing.

Assessment

Find each product.

1. 8×6 48	2. 9×9 81	3. 0×8 0
4. 1×6 6	5. 6×9 54	6. 9×0 0

Pages 98-99

OBJECTIVE

Demonstrate competence in completing basic multiplication facts

Materials

copies of page T 367 for each student (optional), 30 blocks or counters for each student (optional)

Vocabulary

multiplication table

Practice

Copy and complete the multiplication tables.

1.

×	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18

Counting by 2's makes these easy.

2.

×	0	1	2	3	4	5	6	7	8	9
3	0	3	6	9	12	15	18	21	24	27

Try counting by 3's.

3.

×	0	1	2	3	4	5	6	7	8	9
4	0	4	8	12	16	20	24	28	32	36

4.

×	0	1	2	3	4	5	6	7	8	9
5	0	5	10	15	20	25	30	35	40	45

5.

×	0	1	2	3	4	5	6	7	8	9
6	0	6	12	18	24	30	36	42	48	54

6.

×	0	1	2	3	4	5	6	7	8	9
7	0	7	14	21	28	35	42	49	56	63

7.

×	0	1	2	3	4	5	6	7	8	9
8	0	8	16	24	32	40	48	56	64	72

8.

×	0	1	2	3	4	5	6	7	8	9
9	0	9	18	27	36	45	54	63	72	81

9.

×	2
0	0
1	2
2	4
3	6
4	8
5	10
6	12
7	14
8	16
9	18

10.

×	3
0	0
1	3
2	6
3	9
4	12
5	15
6	18
7	21
8	24
9	27

11.

×	4
0	0
1	4
2	8
3	12
4	16
5	20
6	24
7	28
8	32
9	36

12.

×	5
0	0
1	5
2	10
3	15
4	20
5	25
6	30
7	35
8	40
9	45

13.

×	6
0	0
1	6
2	12
3	18
4	24
5	30
6	36
7	42
8	48
9	54

14.

×	7
0	0
1	7
2	14
3	21
4	28
5	35
6	42
7	49
8	56
9	63

15.

×	8
0	0
1	8
2	16
3	24
4	32
5	40
6	48
7	56
8	64
9	72

16.

×	9
0	0
1	9
2	18
3	27
4	36
5	45
6	54
7	63
8	72
9	81

98

LESSON ACTIVITY

Using the Pages

- This lesson organizes basic multiplication facts in the form of tables to help students see number patterns and to assist them in memorizing the facts. In Ex. 1-8, the tables emphasize each of the numbers 2 to 9, in turn, as the first factor. In Ex. 9-16, the tables show each of 2 to 9, in turn, as the second factor. For example, Ex. 13 emphasizes 6 as the second factor and students think 0×6, 1×6, 2×6, . . ., 9×6 to complete the table. Students will be able to use the completed tables for assistance in answering Ex. 17-26. Ex. 26 is starred since its solution requires more than one step.

  Begin with a brief discussion of the photograph on page 99. Have students identify which cereal they prefer and find the number of boxes of that cereal they can see on one shelf. Establish the fact that multiplication is useful for finding the number of boxes. The photograph can be related to most of the exercises below it. For example, Ex. 17 c be related to the number of boxes of Rice Krispies that c be seen on the top shelf.

  If you wish, provide each student with copies of pa T 367 on which to draw and complete their tables for E 1-16.

Problem Solving: This type of word problem can lead studer to consider a number in terms of its factors. The factors 30 are 1, 2, 3, 5, 6, 10, 15, 30. If we assume that Silv wants to place the same number of boxes in each stac then there are eight possible ways to stack the boxes: o stack of 30, two stacks of 15, three stacks of 10, and so o Many students will likely use a trial-and-error approach the solution and use diagrams to show their answers. Son students may find it helpful to experiment with 30 blocks 30 counters to find possible ways of arranging them. Y may wish to challenge a few students to find all the ways stacking the boxes for each exercise.

Write a multiplication fact to answer each question.

17. 7 stacks. 6 boxes in each.
How many boxes in all? 7×6=42

18. 2 stacks. 6 boxes in each.
How many boxes in all? 2×6=12

19. 2 stacks. 7 boxes in each.
How many boxes in all? 2×7=14

20. 3 stacks. 7 boxes in each.
How many boxes in all? 3×7=21

21. 5 stacks. 6 boxes in each.
How many boxes in all? 5×6=30

22. 6 stacks. 5 boxes in each.
How many boxes in all? 6×5=30

23. 4 stacks. 7 boxes in each.
How many boxes in all? 4×7=28

24. 5 stacks. 5 boxes in each.
How many boxes in all? 5×5=25

25. 6 stacks. 7 boxes in each.
How many boxes in all? 6×7=42

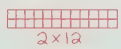
***26.** 6 stacks. 7 boxes in 5 stacks. 6 boxes in one stack. How many boxes? (7×5)+6=41

Silvio has to stack 30 boxes of cereal.

1. Show three different ways he could do this.
2. A customer buys 6 boxes. Show how Silvio could restack the boxes that are left.

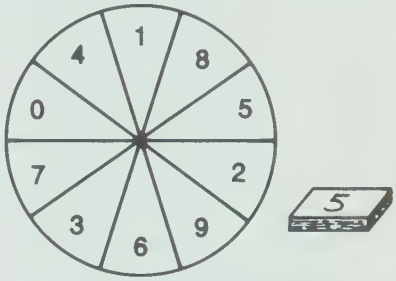
PROBLEM SOLVING

Some possible ways: 3 rows with 10 boxes in each; 10 rows with 3 boxes in each; 5 rows with 6 boxes in each; 6 rows with 5 boxes in each; 5 layers with 6 boxes in each; 6 layers with 5 boxes in each.

Three possible answers are given.  2×12 or 3×8 or 4×6

RELATED ACTIVITIES

• Students may play the game "Circle Once", using two or three sets of numeral cards showing 0 to 9 and one circular game board showing the numerals 0 to 9 in any order. The numeral cards are shuffled and placed face down. The first player exposes the top card and names the product of the number shown and each of the numbers in turn on the game board. If the products are correct, the player keeps the card. If not, the card is placed at the bottom of the stack. The player with the most cards at the end of a specified time is the winner.



• Much discussion can evolve from the tables on page 98. For example, the products in Ex. 3 are double the corresponding products in Ex. 1. By adding pairs of corresponding products in Ex. 2 and 4, the products for Ex. 7 are obtained. For the products in Ex. 4 (or Ex. 12) the ones' digit is always 5 or 0. Many similar patterns can be discovered by students with guidance from the teacher.

Pages 100-101

LESSON OUTCOME

Use a multiplication table to complete basic multiplication facts

Materials

a copy of pages T361 and T367 and a red crayon for each student

Vocabulary

multiple

A Table of Basic Multiplication Facts

All the multiplication facts that you gave for page 98 can be found in this multiplication table.

×	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
7	0	7	14	21	28	35	42	49	56	63
8	0	8	16	24	32	40	48	56	64	72
9	0	9	18	27	36	45	54	63	72	81

For example, all the **multiples of** 3 are in line with the factor 3.

×	0	1	2	3	4	5	6	7	8	9
0				0						
1				3						
2				6						
3	0	3	6	9	12	15	18	21	24	27
4				12						
5				15						
6				18						
7				21						
8				24						
9				27						

1. 0, 8, 16, 24, 32, 40, 48, 56, 64, 72
2. 0, 5, 10, 15, 20, 25, 30, 35, 40, 45
3. 0, 7, 14, 21, 28, 35, 42, 49, 56, 63
4. 0, 9, 18, 27, 36, 45, 54, 63, 72, 81

A multiple of a number is the product of that number and any other number.

Working Together

From the table above,

1. give the multiples of 8.
2. give the multiples of 5.

Without using the table above,

3. list the multiples of 7.
4. list the multiples of 9.

Use the table to complete these.

5. $7 \times 3 = 3 \times$ ▢ 7
6. ▢ $\times 9 = 9 \times 6$ 6
7. $1 \times 8 = 8 \times$ ▢ 1
8. $5 \times 0 =$ ▢ $\times 5$ 0

1. 0, 3, 6, 9, 12, 15, 18, 21, 24, 27
2. 0, 4, 8, 12, 16, 20, 24, 28, 32, 36
3. 0, 2, 4, 6, 8, 10, 12, 14, 16, 18
4. 0, 6, 12, 18, 24, 30, 36, 42, 48, 54
6. 0, 1, 2, 3, 4, 5, 6, 7, 8, 9

Exercises

Without using the table above,

1. list the multiples of 3.
2. list the multiples of 4.

List each of these.

3. the multiples of 2
4. the multiples of 6
5. the multiples of 0 0
6. the multiples of 1

Give the rule for multiplying

7. when 0 is a factor.
8. when 1 is a factor.

Exercises
7. When multiplying with 0 as a factor, the product is 0
8. When multiplying with 1 as a factor, the product is the other factor

LESSON ACTIVITY

Using the Pages

- The individual multiplication tables that were presented in the previous lesson are now brought together in the form of one large multiplication table for all the facts to 9 × 9. Have the students compare this table with those they completed on page 98. For example, discuss that Ex. 8 on page 98 is seen as the last row of the table on page 100, and Ex. 10 is seen in the fifth column.

  Read the statements to introduce the term *multiples*. Discuss that multiples of 3 are seen in two places in the table: the column beneath the factor 3, and the row to the right of the factor 3. Have a student read the multiples of 3 aloud. Have students describe two places in the table where the multiples of 4 are found and read the multiples aloud. Discuss the reasons for the zeros in the row and column for multiples of zero. Also discuss the method of using the table to find the product of two numbers. For example, to find 4 × 7, the students may trace along the "4-row" and down the "7-column" with their fingers to find where t two meet. Ask them to find the product of the same t numbers another way. (Use the "7-row" and the ' column".) Have the students find places in the table t show 8 as the product and name the corresponding facto

Working Together: Ex. 1 and 2 examine the skill of locati multiples of a number in the multiplication table. Ex. 3 a 4 examine whether students understand the concept multiples of a number as the product of that number a any other number. You may wish to have the students u the table to check their answers. Ex. 5-8 deal with using t table to find products and, at the same time, emphasize t order property of multiplication. Use other similar ex cises as needed.

Exercises: Encourage the students to complete as ma exercises as possible without using the table on page 100. will be beneficial to discuss several of the exercises ora when the students have finished them. For examp discuss 0 and 1 as factors (Ex. 7 and 8), pointing out t corresponding rows and columns in the table on page 10

For this multiplication table,

9. what is special about the two factors that give the products shown?

On grid paper, copy and color the table as shown.

10. Write the products for the red spaces.

11. Use the products shown in your red spaces to help you fill in the grey spaces.

9. The two factors are the same

10.

2								
3	6							
4	8	12						
5	10	15	20					
6	12	18	24	30				
7	14	21	28	35	42			
8	16	24	32	40	48	56		
9	18	27	36	45	54	63	72	

×	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9
2		4	6	8	10	12	14	16	18
3			9	12	15	18	21	24	27
4				16	20	24	28	32	36
5					25	30	35	40	45
6						36	42	48	54
7							49	56	63
8								64	72
9									81

Example: $6 \times 3 = 3 \times 6$, so the product in the red 6×3 space will also be in the grey 3×6 space.

Complete each of these. Use the red and grey parts of your table to help you if needed.

12. $7 \times 5 = 5 \times 7$

13. $8 \times 6 = 6 \times 8$

14. $8 \times 4 = 4 \times 8$

15. $9 \times 7 = 7 \times 9$

***16.** $\square \times 5 = 5 \times \square$ Any number from 0 to 9 may be used.

***17.** $9 \times \square = \square \times 9$ Any number from 0 to 9 may be used.

Copy the cross-number puzzle on grid paper and complete.

a 2	7		b 6	3	
4		c 5	4		d 2
	e 1	6		f 1	8
g 4	2		h 4	5	
9		i 1	8		j 8
	k 2	4		l 2	1
m 3	0		n 3	5	
6		o 1	6		p 7
	q 4	0		r 1	2

Across

a. 9×3
b. 7×9
c. 9×6
e. 4×4
f. 2×9
g. 6×7
h. 9×5
i. 6×3
k. 8×3
l. 7×3
m. 5×6
n. 5×7
o. 2×8
p. 7×1
q. 5×8
r. 2×6

Down

a. 6×4
b. 8×8
c. 8×7
d. 7×4
e. 3×4
f. 5×3
g. 7×7
h. 6×8
i. 7×2
j. 9×9
k. 5×4
l. 5×5
m. 4×9
n. 6×6
o. 2×5
p. 9×8

101

Discuss the products for pairs of equal factors (Ex. 9) and the fact that the diagonal in which they belong separates the table into two identical parts (Ex. 10 and 11). Note that each student will require a copy of page T361 to show Ex. 10 and 11 and a copy of page T367 for the cross-number puzzle.

Ex. 12-17 emphasize the commutative (order) property of multiplication. Have the students use the table from Ex. 11 to check their answers. Ex. 16 and 17 are starred as there is more than one answer for each.

Some students may need to be reminded of the procedure for completing the cross-number puzzle.

sessment

mplete.

$4 \times 7 = \square \times 4$ 7

$\square \times 3 = 3 \times 5$ 5

ltiply.

9×6 54 **4.** 4×8 32 **5.** 7×7 49

RELATED ACTIVITIES

- Prepare a number board for use as a multiplication table as described on page T345 and a set of numeral tags for factors and products. Arrange the factor tags in order in the top row and the left column. Have students help to hang the product tags. Vary the activity by arranging the factor tags in a different order.
- The students may play a game using a copy of page T350 and a number spinner for 0 to 9. The first player spins the spinner twice to obtain two factors (6 and 2) and finds their product (12). Then the player colors inside all the squares for that product, such as 2×6, 3×4, 4×3, and 6×2. The other player now has a turn, but a different color is used to show the products in the table. At the end of a given time, or after an agreed number of rounds, the player with the most squares marked in her/his color wins. If a player forgets to mark one or more squares, the other player may mark the squares before taking her/his turn.

Pages 102-103

LESSON OUTCOME

Determine the missing factor in a multiplication fact

Vocabulary

missing factor

Prerequisite Skills

Complete basic multiplication facts

Checking Prerequisite Skills

Multiply.

1. 4×9 36 **2.** 6×7 42
3. 8×5 40 **4.** 0×6 0
5. 9×1 9 **6.** 3×7 21

Finding the Missing Factor

The 7 submarine sandwiches get the same number of tomato slices. There are 28 tomato slices. How many tomato slices does each submarine sandwich get?

Think

28 tomato slices.
7 submarine sandwiches with ⋮ slices on each.
$7 \times \vdots = 28$

Think of this multiplication table to help you find the missing factor.

×	0	1	2	3	4	5	6	7	8	9
7	0	7	14	21	28	35	42	49	56	63

Write $7 \times 4 = 28$

Each submarine sandwich gets 4 tomato slices.

102

LESSON ACTIVITY

Using the Pages

- Begin with a brief discussion of the photograph. Ask questions to establish that the girl is preparing 7 submarine sandwiches using meat, cheese, and tomato slices. Have a student read the sentences aloud to introduce the word problem. Discuss that thinking of a multiplication sentence is helpful in finding the answer.

  The worked example presents a multiplication sentence for which one factor is missing. Point out how the multiplication table shown is helpful in finding the missing factor and thus the number of tomato slices for each sandwich. Ask how many tomato slices each sandwich would get if there were, for example, 42 tomato slices in all. Show the sentence $7 \times \vdots = 42$ on the board and have a student write the missing factor for the place holder.

Working Together: Multiplication tables are provided for Ex. 1-5 to help students think of a multiplication fact when finding a missing factor. Ask the students about th possible choices; for example, for Ex. 2, "How can yo tell the missing factor is not 7?" Note that horizontal table are more helpful in finding the missing second factor (Ex. and 2), whereas vertical tables are more helpful in findin the missing first factor (Ex. 3-5).

If necessary, have the students refer to the multiplicatio table on page 100 to help them find the missing factors fo Ex. 6-9. Have them suggest why the missing factors for Ex 8 and 9 can be named quite quickly.

Exercises: Some exercises involve a missing factor and others missing product. Note that multiplication sentences ar shown with products not only on the right side of th equation (Ex. 1, for example) but also on the left side (Ex 7, for example).

Multiplication sentences with one missing factor help t prepare students for the work with division in Unit 6 Encourage the students to complete as many exercises a possible without referring to the multiplication table o page 100.

Working Together

Use the tables to help you complete each multiplication fact.

×	5	6	7
4	20	24	28

×	7	8	9
7	49	56	63

1. 4 × ___ = 28 7
2. 7 × ___ = 56 8
3. ___ × 6 = 48 8
4. ___ × 9 = 54 6
5. ___ × 6 = 42 7

×	6
7	42
8	48
9	54

×	9
6	54
7	63
8	72

Complete.

6. 8 × ___ = 56 7
7. ___ × 9 = 36 4
8. ▒ × 5 = 0 0
9. 3 × ___ = 3 1

Exercises

Complete.

1. ___ × 4 = 24 6
2. 6 × ___ = 54 9
3. 8 × 2 = 16
4. ___ × 5 = 25 5
5. 2 × ___ = 14 7
6. 9 × 1 = 9
7. 21 = 3 × ___ 7
8. 32 = ___ × 4 8
9. ___ × 7 = 35 5
10. 9 = 9 × ___ 1
11. 8 × ___ = 0 0
12. ___ × 6 = 18 3
13. ___ = 7 × 7 49
14. ___ × 4 = 4 1
15. 5 × ___ = 40 8
16. 9 × ___ = 54 6
17. 0 = ___ × 2 0
18. 4 × 7 = ▒ 28
19. ___ = 6 × 5 30
20. 42 = 7 × ___ 6
21. 4 × ▒ = 20 5
22. 24 = 6 × ___ 4
23. 4 × ___ = 8 2
24. ___ × 9 = 27 3
25. 0 × 4 = 0
26. 9 × ▒ = 45 5
27. 54 = ___ × 6 9
28. 6 × ___ = 0 0
29. 2 × ___ = 18 9
30. ___ × 1 = 7 7
31. ___ = 3 × 3 9
32. 3 × ___ = 24 8
33. ___ × 8 = 16 2
34. 16 = ___ × 4 4

Complete this table.

1.

1 × 9 =	9
2 × 9 =	18
3 × 9 =	27
4 × 9 =	36
5 × 9 =	45
6 × 9 =	54
7 × 9 =	63
8 × 9 =	72
9 × 9 =	81

2. Do you see any patterns in the products?

Complete this table.

3.

1 × 9 =	9
10 × 9 =	90
2 × 9 =	18
9 × 9 =	81
3 × 9 =	27
8 × 9 =	72
4 × 9 =	36
7 × 9 =	63
5 × 9 =	45
6 × 9 =	54

4. Do you see any patterns?

Can you complete any of these?

5. 9 × ___ = 7 9×3=27
6. 6 × ___ = 4
7. ___ × 9 = 3

6. 6×4=24 or 6×9=54
7. 7×9=63

try this

2. Each product is greater by 9 than the preceding one. The tens increase while the ones decrease.
4. The digits in each pair of products are reversed.

RELATED ACTIVITIES

- Have students complete tables similar to the following.

×	4		9			
6		48		18	0	42

×	8
	56
5	
	24
	8

- Have a group of students sit in a circle. Each student is given a numeral card for one of the numbers from 0 to 9. Have one student stand in the center of the circle and show her/his numeral card to a player in the circle. That player silently multiplies that number and her/his own number and states the product. The player in the center tries to identify the other player's number by thinking of a multiplication sentence with a missing factor. If correct, the player has earned another turn in the center. If a player earns three turns in the center, he/she is replaced by another player. If the player in the center holds a numeral card for zero, ten other factors are possible (0 to 9). It will be interesting to see how many guesses are required to identify the other factor.

This: These exercises give students an opportunity to discover patterns in products when one of the factors is 9; for example, the sum of the digits is always 9. Also, the ten's digit is one greater each time while the one's digit is one less each time when the products are shown in sequence (Ex. 1 and 2). If 9 is the second factor as in Ex. 1, then the tens' digit of the product is one less than the first factor. The order presented in Ex. 3 shows how the digits are reversed in pairs of products. Have several students describe the patterns they find in their own words. Have them suggest how the patterns were helpful in completing Ex. 5-7.

An investigation of products when 9 is a factor may lead students to examine other products in a similar way and help them to develop familiarity with factors and products.

Assessment

Complete.

1. ▒ × 7 = 21 3
2. 4 × ▒ = 24 6
3. 5 × ▒ = 40 8
4. ▒ × 6 = 36 6
5. 8 × ▒ = 72 9
6. ▒ × 4 = 36 9

Pages 104-105

OBJECTIVE

Demonstrate competence in completing basic multiplication facts; solve related word problems

Materials

copies of page T 367 (optional)

Practice

Copy and complete the multiplication tables.

1.

×	5	2
2	10	4
3	15	6

2.

×	4	9
7	28	63
5	20	45

× 5 = 15

3.

×	3	8	1	6
4	12	32	4	24
7	21	56	7	42
8	24	64	8	48
6	18	48	6	36

Complete.

4. ___ × 6 = 30 5
5. 6 × ___ = 42 7
6. ___ = 3 × 6 18
7. ___ × 3 = 18 6
8. 8 × ___ = 56 7
9. ___ = 7 × 2 14
10. ___ × 5 = 40 8
11. 9 × 7 = ___ 63
12. 27 = 9 × ___ 3
13. 3 × ___ = 12 4
14. ___ × 9 = 72 8
15. ___ = 9 × 9 81

Linda invented this tool. Use the table to help you find out what she called it.

16.

×	4	8	5
5	E	I	L
9	M	P	R
7	S	T	U

36 35 25 56 40 72 25 40 20 45 28
M U L T I P L I E R S

Solve.

17. 4 cans of apple juice in each sleeve. How many cans are in 6 sleeves? 24
18. 2 pouches of chicken coating mix in each box. How many pouches are in 7 boxes? 14
19. 5 packs of gum in each Family Pack. How many packs of gum are in 3 of the Family Packs? 15
20. 2 cuplets of yogurt in each sleeve. How many cuplets are in 9 sleeves? 18
21. 3 pouches for orange drink in each bag. How many pouches are in 8 bags? 24
22. 8 cinnamon rolls in each tube. How many cinnamon rolls are in 2 tubes? 16

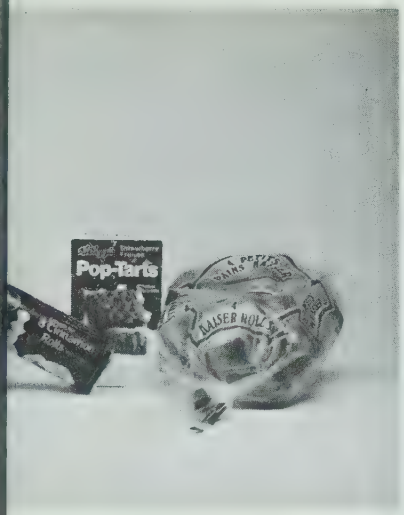
104

LESSON ACTIVITY

Using the Pages

- The photograph can motivate a discussion of the different ways various foods are packaged for sale. Have the students suggest the number of items (cans, packs, tarts, and so on) that are contained in each package. The word problems in Ex. 17-29 are related to the objects in the photograph and provide examples of everyday situations in which multiplication is useful. Ex. 27-29 are starred as their solutions may require more than one step; also some of the necessary information must be obtained from an earlier exercise or from the photograph. For example, for Ex. 27, students must recall or search for the information regarding the number of packs in a Family Pack (see Ex. 19 or the photograph).

Try This: You may wish to provide students with copies of page T 367 for preparing their tables. The game will provide practice in multiplication.



23. 6 tarts in each box. How many tarts are in 5 boxes? 30

24. 4 kaiser rolls in each bag. How many rolls are in 4 bags? 16

25. 4 servings of apple juice in each sleeve. How many servings are in 5 sleeves? 20

26. 3 servings in each pouch for orange drink. How many servings are in 9 pouches? 27

*27. 7 sticks of gum in each pack. How many sticks are in all the packs of a Family Pack? 35

*28. Are there more kaiser rolls in 8 bags than cinnamon rolls in 4 tubes? no

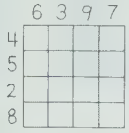
*29. Which has more, 6 boxes of tarts or 4 tubes of cinnamon rolls? How many more? 6 boxes of tarts, 4 more

The Multi-Table Game
(two or more players)

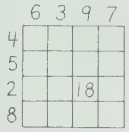
Rules

1. Each player draws a square with 16 smaller squares.

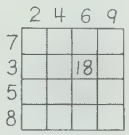
2. The players write the numbers 2 to 9 in any order.



3. First player calls out a product and writes it in the correct square.

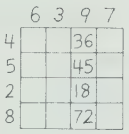


4. Other players check their squares to see if they can fill in this product.



5. Players take turns calling products.

6. The player who first completes four products in line scores four points.



7. Play continues for four rounds.

try this

105

RELATED ACTIVITIES

- To help students memorize the basic multiplication facts, have each student work with a partner orally for the tables on page 98. One student selects a table and names the products while the other student checks the answers. Then the roles are reversed. Students may spend a few moments each day in this way and thus be encouraged to master the facts. They may keep a record of facts they have mastered and note the daily improvement in attaining their goal.
- Have the students bring containers from home similar to the ones shown on pages 104 and 105, or have them cut pictures from magazines and catalogs. These may be displayed and students may be asked to write word problems about the containers (similar to Ex. 17-29) for other students to solve.
- The game described in *Related Activities* on page T 109 may be made more challenging by having students use a blank multiplication table for basic facts (see page T 361). As a further challenge, the factors may be written in random order.

Pages 106-107

LESSON OUTCOME

Multiply a multiple of ten from 10 to 90 by a one-digit number

Materials

models for hundreds and tens

Prerequisite Skills

Complete basic multiplication facts; express a multiple of ten as a number of tens

Checking Prerequisite Skills

Multiply.

1. 9×4 36
2. 8×7 56
3. 6×5 30

4. 5 × 7 = 35
5. 3 × 3 = 9
6. 7 × 2 = 14

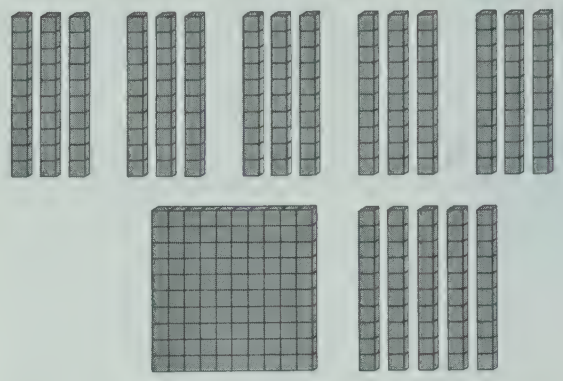
Complete.

7. 8 tens = 80
8. 15 tens = 150
9. 7 tens = 70
10. 12 tens = 120

10 and Multiples of 10 as Factors

What is the product of 5 and 30?

For 5×30, think of 5 groups of 30, or 5 groups of 3 tens.



$5 \times 3 = 15$

5×3 tens = 15 tens

$5 \times 30 = 150$

15 tens = 1 hundred 5 tens or 150.

The product of 5 and 30 is 150.

Take another look:

3 tens	30
5	5
15 tens	150

Working Together

Complete.

1. $2 \times 4 = 8$; 2×4 tens = 8 tens; $2 \times 40 = 80$
2. $3 \times 1 = 3$; 3×1 ten = 3 tens; $3 \times 10 = 30$
3. $4 \times 7 = 28$; 4×7 tens = 28 tens; $4 \times 70 = 280$
4. $3 \times 20 = 60$
5. $8 \times 10 = 80$
6. $5 \times 60 = 300$

Multiply.

7. 30 × 2 = 60
8. 40 × 4 = 160
9. 10 × 5 = 50
10. 80 × 5 = 400
11. 50 × 2 = 100
12. 60 × 7 = 420

106

LESSON ACTIVITY

Before Using the Pages

- Have each of four students, in turn, display a group of 3 tens. Then ask,
  "How many groups are there?"
  "How many tens are in each group?"
  "How many tens are there in all?"
  "What number is named by twelve tens?"
  "What can take the place of ten tens?"
  Emphasize that 12 tens names the same number as 1 hundred 2 tens, namely, 120.
  Use other similar examples as needed.

Using the Pages

- The term *multiple* was first met in the lesson on page 100. Review the term now and have several students suggest two-digit numbers and three-digit numbers that are multiples of ten and others that are not multiples of ten.
- To multiply ten and multiples of ten by a one-digit numb students are encouraged to apply their knowledge of ba multiplication facts. The example illustrates that know the basic fact $5 \times 3 = 15$ helps in finding $5 \times 30 = 1$ This is seen more clearly by first thinking of multiplication 5 × 3 tens = 15 tens.
  Lead the students through the worked example by aski questions similar to those in *Before Using the Pages*. Dr particular attention to the two exercises that follow statement, "Take another look".

Working Together: For each of Ex. 1-3, the steps are sho for extending a basic multiplication fact to find the prod of a one-digit number and a multiple of ten. Some stude may need other exercises of the same type to help th develop the thought process. Ex. 4-12 offer both horizon and vertical forms for multiplication and require students complete the multiplication in one step. For each of thes it would be helpful to have students name the ba multiplication fact that helps in finding the product.

Exercises

Multiply.

1. 4×80 320	**2.** 1×50 50	**3.** 7×10 70	**4.** 6×40 240	**5.** 7×30 210
6. 7×70 490	**7.** 3×40 120	**8.** 9×30 270	**9.** 8×50 400	**10.** 3×80 240
11. 6×30 180	**12.** 7×50 350	**13.** 5×40 200	**14.** 5×70 350	**15.** 9×90 810

16. 40 × 2 = 80	**17.** 90 × 5 = 450	**18.** 60 × 3 = 180	**19.** 10 × 9 = 90	**20.** 80 × 7 = 560	**21.** 60 × 6 = 360	**22.** 90 × 4 = 360
23. 30 × 3 = 90	**24.** 20 × 8 = 160	**25.** 50 × 5 = 250	**26.** 70 × 9 = 630	**27.** 90 × 6 = 540	**28.** 70 × 6 = 420	**29.** 20 × 5 = 100
30. 90 × 2 = 180	**31.** 50 × 4 = 200	**32.** 40 × 7 = 280	**33.** 10 × 6 = 60	**34.** 70 × 8 = 560	**35.** 60 × 8 = 480	**36.** 50 × 3 = 150

Copy and complete the tables.

37.

×	20	30	50	70	80	90
4	80	120	200	280	320	360

38.

×	20	30	40	50	70	80
5	100	150	200	250	350	400

39.

×	20	40	50	60	80	90
6	120	240	300	360	480	540

40.

×	20	30	40	60	70	90
7	140	210	280	420	490	630

41.

×	30	40	60	70	80	90
8	240	320	480	560	640	720

42.

×	20	40	50	60	70	80
9	180	360	450	540	630	720

Add.

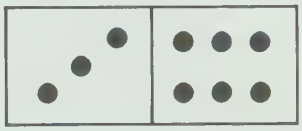
1. 21 + 60 = 81	**2.** 6 + 90 = 96	**3.** 48 + 560 = 608	**4.** 9 + 630 = 639	**5.** 49 + 490 = 539	**6.** 32 + 80 = 112
7. 3 + 60 + 900 = 963	**8.** 32 + 80 + 400 = 512	**9.** 4 + 160 + 600 = 764	**10.** 3 + 90 + 2400 = 2493	**11.** 56 + 280 + 700 = 1036	**12.** 9 + 810 + 3600 = 4419
13. 48 + 80 + 4000 = 4128	**14.** 42 + 480 + 3000 = 3522	**15.** 72 + 480 + 5600 = 6152	**16.** 42 + 560 + 6300 = 6902	**17.** 48 + 480 + 4800 = 5328	

KEEPING SHARP

RELATED ACTIVITIES

- Students who require further practice with basic multiplication facts may play a game using a set of dominoes and game cards marked with products similar to the one shown. Each player selects one game card. The dominoes are placed face down and each player, in turn, draws one domino. If the product of the two numbers represented on the domino appears on a player's card, the domino is placed over the product on the card. If not, the domino is returned face down to the pile and the dominoes are mixed. The first player with three dominoes in line wins.

6	32	45
18	49	2
20	0	18



- Students may work in pairs for the following activity. One student writes any basic multiplication fact in vertical form. The other student writes the corresponding fact for a multiple of ten, for example,

$$\begin{array}{r} 3 \\ \times\ 6 \\ \hline 18 \end{array} \qquad \begin{array}{r} 30 \\ \times\ 6 \\ \hline 180 \end{array}$$

The roles may be reversed after several exercises.

Exercises: You may wish to have the students compare the completed tables of Ex. 37-42 with some of those from page 98.

Keeping Sharp: Although these exercises appear to provide practice only in addition, a closer look at the addends involved will reveal that additions of this type will be encountered in multiplication in the next lesson and several lessons thereafter. For example, Ex. 10 can be related to the following multiplication.

$$\begin{array}{r} 831 \\ \times\ 3 \\ \hline 3 \\ 90 \\ 2400 \\ \hline 2493 \end{array}$$

Note that it is important to keep the digits of the addends in their proper columns and the students should be reminded of this. Thus, although some students may be able to compute the additions without copying the exercises, it is advisable to have them copy the exercises in preparation for a similar procedure in the following lessons.

Assessment

Multiply.

1. 9×40 360	**2.** 8×70 560	**3.** 6×50 300
4. 50 × 7 = 350	**5.** 30 × 3 = 90	**6.** 70 × 2 = 140

Pages 108-109

LESSON OUTCOME

Multiply a two-digit number by a one-digit number; solve related word problems

Materials

models for hundreds, tens, and ones

Prerequisite Skills

Complete basic multiplication facts; multiply a multiple of ten from 10 to 90 by a one-digit number

Checking Prerequisite Skills

Multiply.

1. 6 × 5 = 30	**2.** 3 × 8 = 24	**3.** 9 × 7 = 63
4. 80 × 3 = 240	**5.** 60 × 4 = 240	**6.** 90 × 9 = 810

Multiplying Two-Digit Numbers

25 food bags in each box.
How many bags are in 9 boxes?

Multiply 9 and 25.

Multiply
9 × 5 ones or
9 × 5.

	tens	ones
	2	5
×		9
	4	5

Multiply
9 × 2 tens or
9 × 20.

	2	5
×		9
	4	5
1	8	0

Add.

	2	5
×		9
	4	5
1	8	0
2	2	5

There are 225 food bags in 9 boxes.

Working Together

Multiply by following the steps.

1. 13 × 2

Multiply 2 × 3. → 6
Multiply 2 × 10. → 20
Add. → 26

2. 34 × 3

Multiply 3 × 4. → 12
Multiply 3 × 30. → 90
Add. → 102

Multiply.

3. 24 × 2 = 48	**4.** 38 × 3 = 114	**5.** 47 × 6 = 282

108

LESSON ACTIVITY

Before Using the Pages

- Review that 2 × 6 means two groups of six. Ask what 2 × 36 means. Have each of two students use models to represent 36. Emphasize that for 2 groups of 36 there are 2 groups of 6 ones and 2 groups of 3 tens. Demonstrate that 2 groups of 36 represents 72, having students join and regroup the ones first and then the tens.

  Use a similar procedure to demonstrate, for example, that 3 groups of 54 represents 162.

Using the Pages

- Begin with a discussion of the photograph. Have students identify the packages shown and state the number of items in each package. Discuss that multiplication is useful for finding the number of items in several identical packages. Have a student read aloud the word problem for the worked example.

In the worked example, each step of the procedure multiplying 9 and 25 is highlighted in red. In leading t students through the solution, draw attention to the fact th 25 means 2 tens 5 ones, and that 45 (for 9 × 5 ones) written with 4 in the tens' place and 5 in the ones' plac Similarly, review that 18 tens (for 9 × 2 tens) is the san as 1 hundred 8 tens 0 ones, or 180. Have a student perfor the addition of 45 and 180 aloud to draw attention to t regrouping of 10 tens as 1 more hundred.

In summary, review that the ones are multiplied by first, then the tens are multiplied by 9, and finally, additio is performed.

Working Together: Ex. 1 involves no regrouping in th addition stage, whereas Ex. 2 does. Both exercises nam the steps to be followed. Use other similar exercises a needed before assigning the remaining exercises for whic the steps are not named. When the students have complete the exercises, it would be helpful to have several studen describe the steps that were followed to complete Ex. 3-5

Exercises

Multiply.

1. 12 × 9 = 108	2. 34 × 3 = 102	3. 31 × 2 = 62
4. 24 × 4 = 96	5. 41 × 2 = 82	6. 87 × 9 = 783
7. 23 × 3 = 69	8. 10 × 9 = 90	9. 98 × 6 = 588
10. 12 × 4 = 48	11. 86 × 8 = 688	12. 36 × 2 = 72
13. 20 × 4 = 80	14. 23 × 5 = 115	15. 71 × 5 = 355
16. 57 × 3 = 171	17. 96 × 7 = 672	18. 47 × 8 = 376

Solve.

19. 48 ice-cream cups in each box. How many ice-cream cups are in 3 boxes? 144
20. 16 cheese slices in each package. How many slices are in 6 packages? 96
21. 32 fish sticks in each box. How many fish sticks are in 5 boxes? 160
22. 12 granola bars in each box. How many bars are in 7 boxes? 84
23. 24 wheat biscuits in each box. How many biscuits are in 9 boxes? 216
24. 15 tea bags in each box. How many are in 8 boxes? 120
25. 18 beef cubes in each box. How many are in 4 boxes? 72

109

xercises: The problems in Ex. 19-25 may be related to the packages in the photograph. These can help students visualize the word problems and relate the situations to everyday life.

ssessment

lultiply.

. 42 × 2 = 84	2. 16 × 5 = 80	3. 53 × 8 = 424	4. 29 × 7 = 203

olve.

. 16 cheese slices in each package.
How many slices are in 8 packages? 128

RELATED ACTIVITIES

- Have students write word problems for other students to solve. Have them write about items pictured on pages 108 and 109 or other similar items displayed in the classroom.
- Have students help to prepare a display to show that multiplication is an efficient way of performing repeated addition. They may write the solutions for Ex. 19-25 or other similar exercises in two ways, as shown below for Ex. 21.

$$\begin{array}{r} 32 \\ 32 \\ 32 \\ 32 \\ 32 \\ \hline 160 \end{array}$$

$$\begin{array}{r} 32 \\ \times\ \ 5 \\ \hline 10 \\ 150 \\ \hline 160 \end{array}$$

The advantage of multiplication over repeated addition will become even more apparent after the students are introduced to the formal algorithm for multiplication later in this unit.

$$\begin{array}{r} {\scriptstyle 1} \\ 3\,2 \\ \times\ \ 5 \\ \hline 1\,6\,0 \end{array}$$

Pages 110-111

LESSON OUTCOME

Multiply a multiple of one hundred from 100 to 900 by a one-digit number

Prerequisite Skills

Complete basic multiplication facts; express a multiple of one hundred as a number of hundreds

Checking Prerequisite Skills

Multiply.

1. 9 × 4 = 36 **2.** 7 × 8 = 56 **3.** 6 × 9 = 54

Complete.

4. 2 hundreds = 200

5. 14 hundreds = 1400

6. 36 hundreds = 3600

7. 72 hundreds = 7200

100 and Multiples of 100 as Factors

There are 6 prizes of $400 in the grocery store contest. How much prize money is there in all?

Multiply 6 and $400.

$6 \times 4 = 24$

6×4 hundreds $= 24$ hundreds

$6 \times \$400 = \$2400$

Here is another way to multiply 6 and $400:

4 hundreds	$400
× 6	× 6
24 hundreds	$2400

There is $2400 in prize money.

110

LESSON ACTIVITY

Before Using the Pages

- Review that when multiples of ten were introduced as factors, an exercise such as 5 × 30 (page 106) was first thought of as 5 × 3 tens.

  Ask how we might think of an exercise that involves multiples of one hundred as in 5 × 300. Lead the students to suggest 5 × 3 hundreds.

Using the Pages

- The worked example illustrates that multiplying a multiple of one hundred by a one-digit number may be treated as an extension of a basic multiplication fact. Just as 6 × 4 (ones) = 24 (ones), so 6 × 4 hundreds = 24 hundreds, which is written 2400. Both horizontal and vertical forms for multiplication are shown. The illustration reinforces the concept of multiplication as a number of equal groups (6 groups of 4 one-hundred dollar bills).

  Review that the numeral 2400 may be read as "twenty-four hundred" and as "two thousand fo hundred" to emphasize the position of the digit 2.

Working Together: Ex. 1 and 2 show the steps of applying basic multiplication fact to obtain the product. Use oth similar exercises, as required, before assigning Ex. 3-1 When the students have completed the exercises, ha several of them identify basic facts that helped in obtaini the products.

Exercises: Remind the students to show the symbol $ f products in Ex. 29-34. You may wish to have the studer compare their completed tables for Ex. 35-38 with t related tables on page 98.

Assessment

Multiply.

1. 900 × 4 = 3600 **2.** 700 × 8 = 5600 **3.** 600 × 9 = 5400

4. 5 × 200 1000 **5.** 6 × 600 3600 **6.** 3 × 800 2400

Working Together

Complete.

1. $4 \times 7 =$ 28
   4×7 hundreds = hundreds 28
   $4 \times 700 =$ 2800

2. $5 \times 1 =$ 5
   5×1 hundred = hundreds 5
   $5 \times 100 =$ 500

3. $2 \times 400 =$ 800

4. $4 \times 100 =$ 400

5. $8 \times 600 =$ 4800

6. $6 \times 500 =$ 3000

Multiply.

7.	8.	9.	10.	11.	12.
300	700	100	600	500	400
× 3	× 2	× 7	× 5	× 2	× 4
900	1400	700	3000	1000	1600

Exercises

Multiply.

1. 4×200 800	2. 6×600 3600	3. 5×200 1000	4. 5×900 4500
5. 5×700 3500	6. 3×60 180	7. 9×200 1800	8. 7×600 4200
9. 4×600 2400	10. 8×900 7200	11. 4×80 320	12. 4×500 2000
13. 3×700 2100	14. 3×40 120	15. 2×300 600	16. 5×300 1500

17.	18.	19.	20.	21.	22.
800	700	500	20	400	800
× 5	× 7	× 9	× 7	× 5	× 6
4000	4900	4500	140	2000	4800

23.	24.	25.	26.	27.	28.
900	80	900	500	900	600
× 4	× 3	× 3	× 3	× 7	× 2
3600	240	2700	1500	6300	1200

29.	30.	31.	32.	33.	34.
$300	$500	$80	$300	$600	$400
× 8	× 5	× 9	× 4	× 8	× 7
$2400	$2500	$720	$1200	$4800	$2800

Copy and complete the tables.

35.

×	100	200	300	500	700	900
6	600	1200	1800	3000	4200	5400

36.

×	100	300	400	500	700	800
7	700	2100	2800	3500	4900	5600

37.

×	100	200	400	500	700	800
8	800	1600	3200	4000	5600	6400

38.

×	100	300	400	600	700	900
9	900	2700	3600	5400	6300	8100

39.

×	4	5	6	7	8	9
10	40	50	60	70	80	90

40.

×	9	8	7	6	5	4
100	900	800	700	600	500	400

RELATED ACTIVITIES

- Students may work in groups of three for the following activity. One student writes any basic multiplication fact. The second student writes the extension for a multiple of ten. The third writes the extension for a multiple of one hundred. The order of the procedure may vary and the students may change roles from time to time.

7	70	700
× 5	× 5	× 5
35	350	3500

Some may be motivated to extend the concept to thousands (5×7000).

- Students who had difficulty with this lesson may be helped by using models of thousands and hundreds. Adapt the procedure described for hundreds and tens in *Before Using the Pages* on pages T114-T115. For variety, cut-outs from page T352 may be used in place of the models.
- Provide timed activities that require the students to give the product when 10 or 100 is one of the factors. Number wheels and number tables prepared from copies of page T360 are useful in this regard.

To encourage a rapid oral response, use the overhead projector to display exercises. Point to each exercise in turn and have the students say the product. Encourage them to respond with little or no hesitation.

Pages 112-113

LESSON OUTCOME

Multiply a three-digit number by a one-digit number

Prerequisite Skills

Complete basic multiplication facts; multiply a multiple of ten from 10 to 90 by a one-digit number; multiply a multiple of one hundred from 100 to 900 by a one-digit number; add two or three addends in columns

Checking Prerequisite Skills

Multiply.

1. 9 × 9 = 81 **2.** 6 × 7 = 42 **3.** 40 × 5 = 200 **4.** 300 × 8 = 2400

Add.

5. 15 + 210 + 300 = 525 **6.** 24 + 120 + 4200 = 4344 **7.** 81 + 7200 = 7281

Multiplying Three-Digit Numbers

432 rolls in each stack.
How many rolls are in 6 stacks?

Multiply 6 and 432.

hundreds	tens	ones
4	3	2
		6

Multiply 6 × 2 ones or 6 × 2.

4	3	2
		6
		12

Multiply 6 × 3 tens or 6 × 30.

4	3	2
		6
		12
1	8	0

Multiply 6 × 4 hundreds or 6 × 400.

4	3	2
		6
		12
1	8	0
2	4	0

Add.

4	3	2
		6
		12
1	8	0
2	4	0
2	5	9

There are 2592 rolls in 6 stacks.

112

LESSON ACTIVITY

Before Using the Pages

- Review how to find the product of a two-digit number and a one-digit number.

  Complete a few examples similar to the following on the board. Emphasize that the ones are multiplied first, then the tens, and then addition is performed.

$$\begin{array}{r} 32 \\ \times\ 6 \\ \hline 12 \\ 180 \\ \hline 192 \end{array}$$

Using the Pages

- In the worked example the steps of the solution are highlighted by red on the numerals. It is seen that multiplying a three-digit number involves one more step than multiplying a two-digit number, but the general procedure is the same. First the ones are multiplied, then the tens, and then hundreds, and a basic fact is applied in each multiplicat Finally, the partial products are added.
- Begin with a discussion of the photograph. The students suggest that the rolls are those used for hamburg Students who have not seen a bakery in operation may it interesting to discuss that the rolls are removed from ovens on a tray and the trays are stacked on a trolley. them how many rolls are on each tray and how the ans was obtained (6 × 4 or 4 × 6). They may wish to c the number of trays stacked on one side of the trol Suggest that this is referred to as a "stack", and that if sides of a trolley were filled, there would be "two stack Have a student read the problem aloud. Lead the stud through the worked example, emphasizing the asp described in the previous activity.

Working Together: Ex. 1 presents the steps of first multipl the ones, then the tens, then the hundreds, and then ad the partial products. No regrouping is involved. Ex. similar to Ex. 1, except that regrouping is involve

Working Together

Multiply by following the steps.

1. 312 × 4

Multiply 4 × 2. → 8
Multiply 4 × 10. → 40
Multiply 4 × 300. → 1200
Add. → 1248

2. 476 × 8

8 × 6 → 48
8 × 70 → 560
8 × 400 → 3200
Add. → 3808

Multiply.

3. 127 × 4 = 508	**4.** 518 × 8 = 4144	**5.** 697 × 7 = 4879

Exercises

Multiply.

1. 384 × 5 = 1920	**2.** 241 × 6 = 1446	**3.** 327 × 3 = 981
4. 342 × 2 = 684	**5.** 441 × 5 = 2205	**6.** 281 × 4 = 1124
7. 115 × 6 = 690	**8.** 897 × 6 = 5382	**9.** 227 × 5 = 1135
10. 743 × 9 = 6687	**11.** 610 × 2 = 1220	**12.** 345 × 3 = 1035
13. 921 × 9 = 8289	**14.** 698 × 7 = 4886	**15.** 807 × 4 = 3228
16. 254 × 8 = 2032	**17.** 215 × 3 = 645	**18.** 452 × 4 = 1808

Here is a way to multiply with fewer steps.

Multiply 2 and 43.

Step 1

$$\begin{array}{r} 43 \\ \times\ 2 \\ \hline 6 \end{array} \quad 2 \times 3 \rightarrow$$

Step 2

$$\begin{array}{r} 43 \\ \times\ 2 \\ \hline 86 \end{array} \quad 2 \times 4 \text{ tens} \rightarrow$$

Multiply as shown above.

1. 32 × 2 = 64	**2.** 21 × 4 = 84	**3.** 240 × 2 = 480
4. 132 × 3 = 396	**5.** 62 × 4 = 248	**6.** 513 × 2 = 1026
7. 91 × 7 = 637	**8.** 72 × 3 = 216	**9.** 934 × 2 = 1868

10. 32 slices of bread in one loaf. How many slices of bread in 3 loaves? 96

11. 144 rolls in each box. How many rolls in 2 boxes? 288

What happens if you try to multiply these as shown above?

12. 24 × 3 = 72 Ones have to be regrouped

13. 325 × 6 = 1950 Ones and tens have to be regrouped

try this

RELATED ACTIVITIES

- Some students may need the support of models for thousands, hundreds, tens, and ones to help them understand the concepts presented in this lesson. A multiplication may be demonstrated using the models and the exercise may be written afterward. Select exercises that do not become awkward when using models. Use examples similar to the following.

412 × 3	253 × 4	659 × 2

- The photograph on page 112 may challenge some students to investigate multiplication. It is easily seen that there are 18 trays in a stack and that each tray holds 24 rolls. Since the word problem states that there are 432 rolls in each stack, some students may realize that this implies the multiplication $18 \times 24 = 432$. Suggest to such students that they experiment with ways to show $18 \times 24 = 432$.

adding the partial products. Have students describe the steps they used in multiplying in Ex. 3-5. Use other similar exercises as needed.

ercises: Observe the students as they work, cautioning them to write the numerals carefully so that the digits are properly aligned. For example, in Ex. 15 since there are 0 tens in the multiplicand, there will be no tens' product to record — only a ones' product and a hundreds' product.

$$\begin{array}{r} 807 \\ \times\ 4 \\ \hline 28 \text{ (ones' product)} \\ 3200 \text{ (hundreds' product)} \\ \hline 3228 \end{array}$$

This: Many students will readily accept the form for multiplication shown in this feature as it requires fewer steps. The object, of course, is to prepare them for the standard algorithm. However, Ex. 1-11 should present little difficulty since they have been selected so that no regrouping is involved. Students should be encouraged to attempt these with little assistance and so be given the opportunity to discover the procedure for themselves. Ex. 12 and 13 do involve regrouping. Some students may be able to develop their own short forms for these, whereas others will have the mystery unraveled in the following lesson.

Assessment

Multiply.

1. 211 × 4 = 844	**2.** 809 × 9 = 7281	**3.** 175 × 3 = 525	**4.** 724 × 6 = 4344

Pages 114-115

LESSON OUTCOME

Use the standard algorithm to multiply a three-digit number by a one-digit number

Prerequisite Skills

Complete basic multiplication facts; add with regrouping

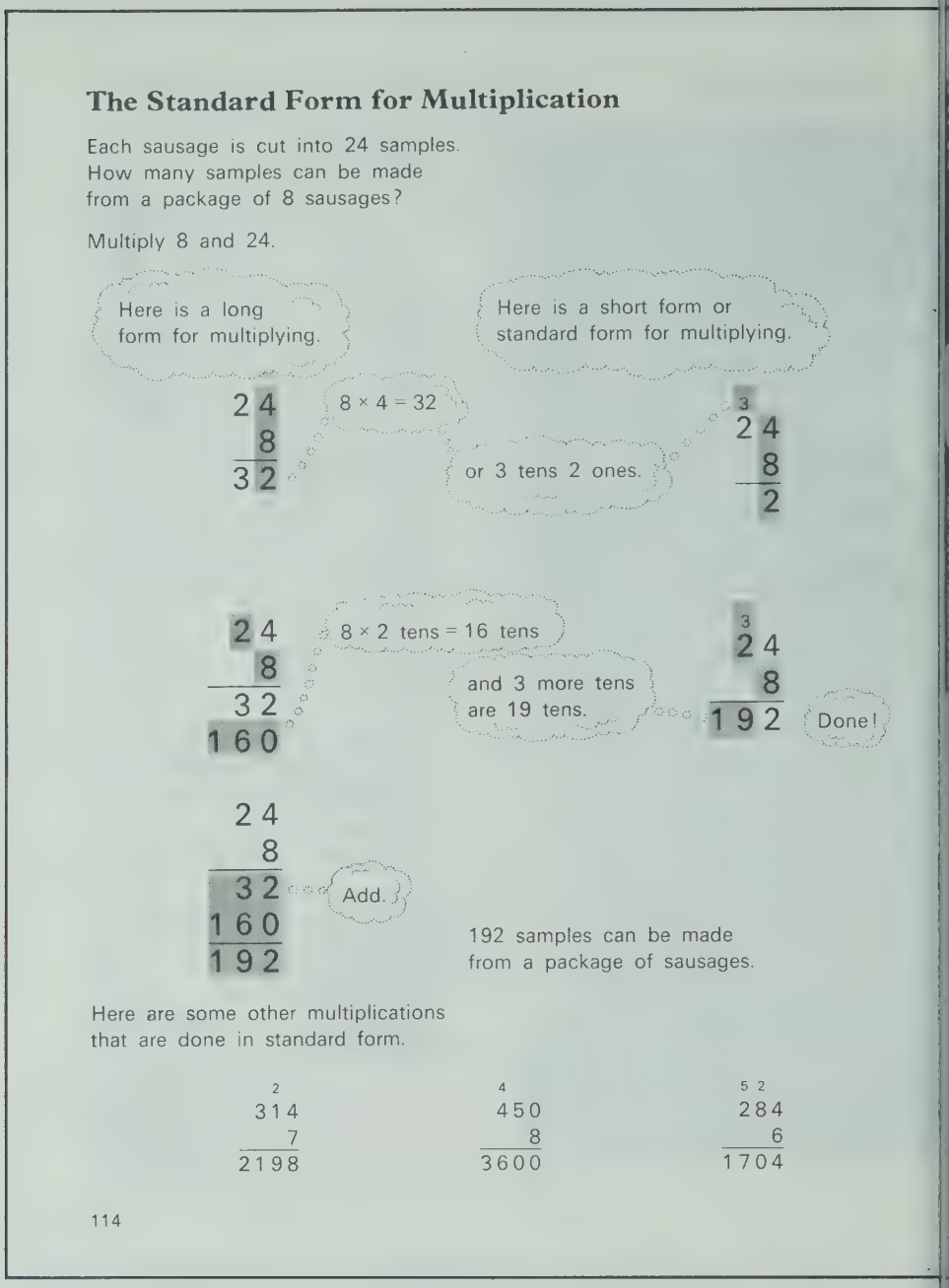
Checking Prerequisite Skills

Multiply.

1.	2.	3.	4.
4	9	8	6
7	9	5	8
28	81	40	48

Add.

5.	6.	7.
162	349	268
162	349	268
324	698	268
		804



The Standard Form for Multiplication

Each sausage is cut into 24 samples. How many samples can be made from a package of 8 sausages?

Multiply 8 and 24.

Here is a long form for multiplying.

Here is a short form or standard form for multiplying.

$$\begin{array}{r} 24 \\ \times\ 8 \\ \hline 32 \end{array}$$

$8 \times 4 = 32$

or 3 tens 2 ones.

$$\begin{array}{r} {\scriptstyle 3} \\ 24 \\ \times\ 8 \\ \hline 2 \end{array}$$

$$\begin{array}{r} 24 \\ \times\ 8 \\ \hline 32 \\ 160 \end{array}$$

8×2 tens $= 16$ tens

and 3 more tens are 19 tens.

$$\begin{array}{r} {\scriptstyle 3} \\ 24 \\ \times\ 8 \\ \hline 192 \end{array}$$

Done!

$$\begin{array}{r} 24 \\ \times\ 8 \\ \hline 32 \\ 160 \\ \hline 192 \end{array}$$

Add.

192 samples can be made from a package of sausages.

Here are some other multiplications that are done in standard form.

$$\begin{array}{r} {\scriptstyle 2} \\ 314 \\ \times\ 7 \\ \hline 2198 \end{array} \qquad \begin{array}{r} {\scriptstyle 4} \\ 450 \\ \times\ 8 \\ \hline 3600 \end{array} \qquad \begin{array}{r} {\scriptstyle 5\ 2} \\ 284 \\ \times\ 6 \\ \hline 1704 \end{array}$$

114

LESSON ACTIVITY

Before Using the Pages

- Have the students complete a few exercises similar to the following to review the procedure of multiplying by a one-digit number.

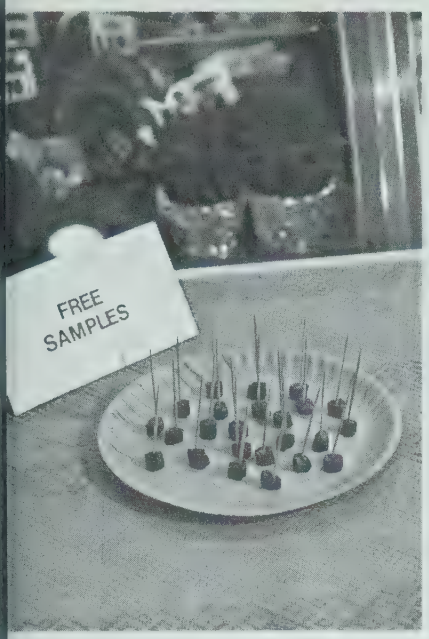
43	127	234	523
$\times$ 2	$\times$ 5	$\times$ 6	$\times$ 9
6	35	24	27
80	100	180	180
86	500	1200	4500
	635	1404	4707

Using the Pages

- Discuss that many grocery stores introduce a new product by offering free samples to customers. The students may count the samples shown on the paper plate in the photograph. Introduce the word problem at the top of page 114. Discuss that multiplication can be used to solve the prob because the situation involves 8 groups of 24.

The worked example shows the multiplication 8 × 2 both the long form and the standard form. Explain that amount of written work can be reduced if the addition s are carried out mentally. The red on the numerals dr attention to important features for discussion. Question students to lead them to contrast each step of the solutions in turn. For example, the digit 3 for 32 is sh in different positions, although each is aligned with tens' place. Have the students recall a similar proce used with regrouping numerals in addition. Pay partic attention to the step of arriving at 19 tens. Emphasize performing this step mentally reduces the written work thus the operation can be completed more efficiently.

Three more examples of multiplication in the stand form are shown at the bottom of page 114. These may discussed orally with the students or the exercises may copied on the board, completed with the students, and t solutions compared with those on the page.



Working Together

Show each multiplication in the standard form.

Example: 45 becomes $\begin{array}{r} {\scriptstyle 1}\\ 45\\ \times\ \ 3\\ \hline 135 \end{array}$

$\begin{array}{r} 45\\ \times\ \ 3\\ \hline 15\\ 120\\ \hline 135 \end{array}$

1. $\begin{array}{r} {\scriptstyle 4}\\ 16\\ \times\ \ 7\\ \hline 112 \end{array}$ (42, 70)
2. $\begin{array}{r} {\scriptstyle 3}\\ 291\\ \times\ \ 4\\ \hline 1164 \end{array}$ (4, 360, 800)
3. $\begin{array}{r} {\scriptstyle 33}\\ 245\\ \times\ \ 7\\ \hline 1715 \end{array}$ (35, 280, 1400)

Multiply. Use the standard form.

4. $\begin{array}{r} 15\\ \times\ \ 8\\ \hline 120 \end{array}$
5. $\begin{array}{r} 291\\ \times\ \ 5\\ \hline 1455 \end{array}$
6. $\begin{array}{r} 382\\ \times\ \ 7\\ \hline 2674 \end{array}$
7. $\begin{array}{r} 73\\ \times\ \ 6\\ \hline 438 \end{array}$
8. $\begin{array}{r} 270\\ \times\ \ 8\\ \hline 2160 \end{array}$
9. $\begin{array}{r} 709\\ \times\ \ 7\\ \hline 4963 \end{array}$

Exercises

Multiply. Use the standard form.

1. $\begin{array}{r} 36\\ \times\ \ 3\\ \hline 108 \end{array}$
2. $\begin{array}{r} 261\\ \times\ \ 6\\ \hline 1566 \end{array}$
3. $\begin{array}{r} 82\\ \times\ \ 3\\ \hline 246 \end{array}$
4. $\begin{array}{r} 758\\ \times\ \ 2\\ \hline 1516 \end{array}$
5. $\begin{array}{r} 406\\ \times\ \ 5\\ \hline 2030 \end{array}$
6. $\begin{array}{r} 43\\ \times\ \ 6\\ \hline 258 \end{array}$
7. $\begin{array}{r} 640\\ \times\ \ 4\\ \hline 2560 \end{array}$
8. $\begin{array}{r} 29\\ \times\ \ 9\\ \hline 261 \end{array}$
9. $\begin{array}{r} 573\\ \times\ \ 7\\ \hline 4011 \end{array}$
10. $\begin{array}{r} 281\\ \times\ \ 9\\ \hline 2529 \end{array}$
11. $\begin{array}{r} 403\\ \times\ \ 6\\ \hline 2418 \end{array}$
12. $\begin{array}{r} 135\\ \times\ \ 9\\ \hline 1215 \end{array}$
13. $\begin{array}{r} 266\\ \times\ \ 7\\ \hline 1862 \end{array}$
14. $\begin{array}{r} 36\\ \times\ \ 4\\ \hline 144 \end{array}$
15. $\begin{array}{r} 349\\ \times\ \ 4\\ \hline 1396 \end{array}$

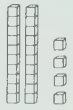
Solve.

16. 192 samples can be made from a package of sausages. How many samples can be made from 7 packages? 1344
17. The boxes of toothpicks hold 450 each. How many toothpicks are in 3 boxes? 1350
18. About 170 samples are eaten each hour. About how many samples are eaten in 8 h? 1360
*19. Each sausage is cut into 24 samples. How many cuts are needed for 8 sausages? 184

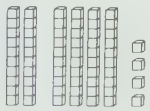
RELATED ACTIVITIES

• Students having difficulties may be helped by demonstrating multiplication using models for thousands, hundreds, tens, and ones. If the basic facts are well-known, then it may not be necessary to set out 4 equal groups of 216, for example, for 4 × 216. It may be sufficient to have a student say that 4 times 6 is 24, display 2 tens and 4 ones (A), and say that the 2 tens will be "saved" for the next step. Then, working with models for tens, 4 times 1 is 4 and the 2 tens that were saved is 6 tens (B). Finally, working with models of hundreds, say that 4 times 2 hundreds is 8 hundreds (C).

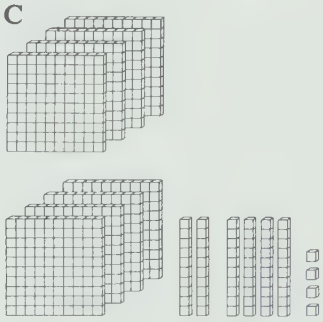
A



B



C



$\begin{array}{r} {\scriptstyle 2}\\ 216\\ \times\ \ 4\\ \hline 4 \end{array}$ $\begin{array}{r} {\scriptstyle 2}\\ 216\\ \times\ \ 4\\ \hline 64 \end{array}$ $\begin{array}{r} {\scriptstyle 2}\\ 216\\ \times\ \ 4\\ \hline 864 \end{array}$

rking Together: Compare the two solutions of the example preceding Ex. 1. Emphasize that there is less written work if the 1 ten from 3 × 5 ones is "saved" above the 4 in the tens' place. Remind the students that although we think "three times four is twelve, plus one is thirteen", for example, we are really working with tens.

3 × 4 tens = 12 tens; 12 tens + 1 ten = 13 tens

Emphasize that the addition of the regrouped number is performed after the multiplication, not before. Have the students write Ex. 1-3 in the standard form and check their products with those on the page. Have students show solutions on the board for Ex. 4-9 and discuss any difficulties that arise. Some students may need help with products that involve zero as in Ex. 8 and 9. For Ex. 9, the following steps are necessary.

1. Multiply ones: 7 × 9 = 63
   Write 3 in the ones' place and "save" 6 tens.
2. Multiply tens: 7 × 0 = 0
3. Add the 6 tens (0 + 6 = 6) and write 6 in the tens' place.
4. Multiply hundreds: 7 × 7 = 49
   Write 49 in the hundreds' place (9 in the hundreds' place and 4 in the thousands' place).

Use other similar examples as needed.

Exercises: Take a few moments to discuss the reasons for using multiplication to solve the word problems in Ex. 16-19. This helps to keep students aware that multiplication concerns finding how many there are in all for a number of equal groups. Ex. 19 will challenge some students. The tendency will be to multiply 8 and 24. Encourage the students to explore the problem by using concrete materials or by drawing diagrams to determine the number of cuts required to obtain 24 samples.

Assessment

Multiply. Use the standard form.

1. $\begin{array}{r} 63\\ \times\ \ 3\\ \hline 189 \end{array}$
2. $\begin{array}{r} 152\\ \times\ \ 4\\ \hline 608 \end{array}$
3. $\begin{array}{r} 89\\ \times\ \ 7\\ \hline 623 \end{array}$
4. $\begin{array}{r} 320\\ \times\ \ 8\\ \hline 2560 \end{array}$
5. $\begin{array}{r} 439\\ \times\ \ 5\\ \hline 2195 \end{array}$

Pages 116-117

OBJECTIVE

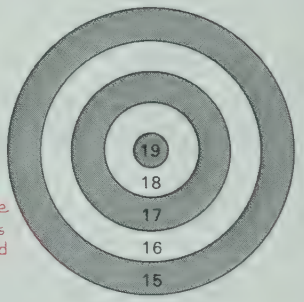
Demonstrate competence in multiplying a three-digit number by a one-digit number using the standard form; solve related word problems

Practice

Multiply. Use the standard form.

1. 434 × 2 = 868	2. 69 × 4 = 276	3. 167 × 5 = 835	4. 134 × 7 = 938	5. 48 × 3 = 144	6. 188 × 5 = 940
7. 76 × 7 = 532	8. 209 × 9 = 1881	9. 41 × 8 = 328	10. 736 × 3 = 2208	11. 117 × 8 = 936	12. 73 × 9 = 657
13. 170 × 3 = 510	14. 98 × 4 = 392	15. 132 × 9 = 1188	16. 303 × 7 = 2121	17. 65 × 3 = 195	18. 662 × 6 = 3972
19. 281 × 4 = 1124	20. 919 × 2 = 1838	21. 81 × 9 = 729	22. 147 × 4 = 588	23. 852 × 2 = 1704	24. 167 × 5 = 835
25. 801 × 9 = 7209	26. 99 × 2 = 198	27. 24 × 7 = 168	28. 255 × 5 = 1275	29. 209 × 9 = 1881	30. 744 × 3 = 2232
31. 476 × 2 = 952	32. 118 × 8 = 944	33. 80 × 3 = 240	34. 435 × 9 = 3915	35. 505 × 7 = 3535	36. 772 × 6 = 4632
37. 585 × 4 = 2340	38. 818 × 2 = 1636	39. 374 × 8 = 2992	40. 952 × 3 = 2856	41. 451 × 6 = 2706	42. 936 × 8 = 7488
43. 896 × 7 = 6272	44. 645 × 9 = 5805	45. 394 × 5 = 1970	46. 839 × 6 = 5034	47. 528 × 8 = 4224	48. 637 × 4 = 2548

Sophia scored 99 in this dart game.



Answers will vary.

1. How many darts did she throw? 6
2. Where did they hit the target?
Possible answers are: one dart on 15, one dart on 16, and 4 darts on 17; two darts on 19, one dart on 16, and 3 darts on 15.

PROBLEM SOLVING

116

LESSON ACTIVITY

Using the Pages

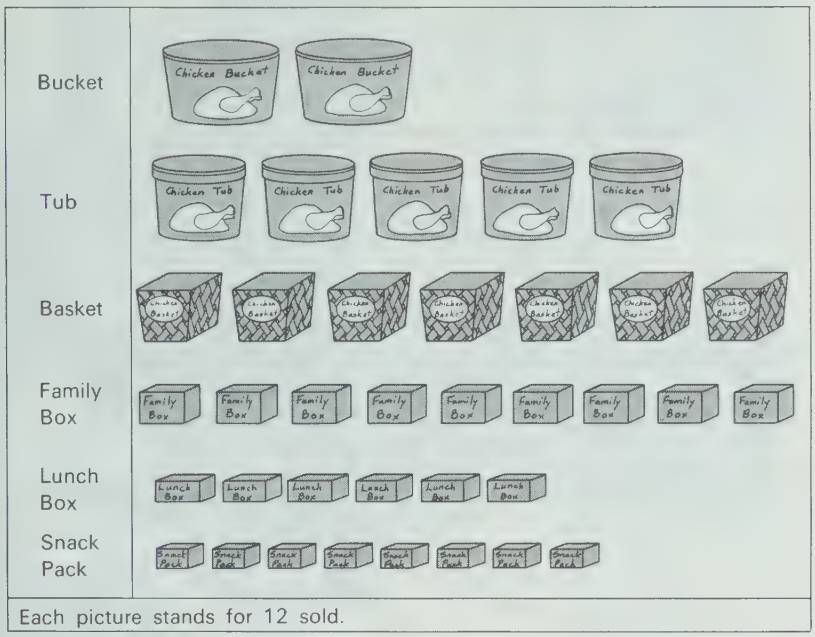
- Ex. 1-48 provide practice in multiplication using the standard form. Multiplication is then applied in interpreting the pictograph and solving the word problems. Ex. 55 and 56 are starred as their solutions involve more than one step. For example, for Ex. 55, it is necessary to find the product $9 \times 12 \times 7$.

Problem Solving: Students may explore this problem over several days and even return to it from time to time over several weeks. The method of "guess and test" (trial and error) will reveal several possible solutions and students can enjoy the feeling of satisfaction in discovering possible ways. The following table illustrates ten possible solutions for throwing six darts. Note that the solutions involve multiplication by a one-digit number. For the first solution, for example, $3 \times 15 = 45$.

45
17
18
19
99

	15	16	17	18	19
1.	3	—	1	1	1
2.	2	2	—	1	1
3.	1	3	1	—	1
4.	2	1	1	2	—
5.	1	1	4	—	—
6.	—	4	1	1	—
7.	2	—	3	1	—
8.	1	3	—	2	—
9.	3	1	—	—	2
10.	3	—	—	3	—

The picture shows how a take-out restaurant sold its chicken.



Each picture stands for 12 sold.

Solve.

49. How many Lunch Boxes were sold? 72

50. How many Family Boxes were sold? 108

51. How many more Snack Packs than Buckets were sold? 72

52. How many Buckets and Tubs were sold? 84

53. Each Tub holds 15 pieces of chicken. How many pieces are in 8 Tubs? 120

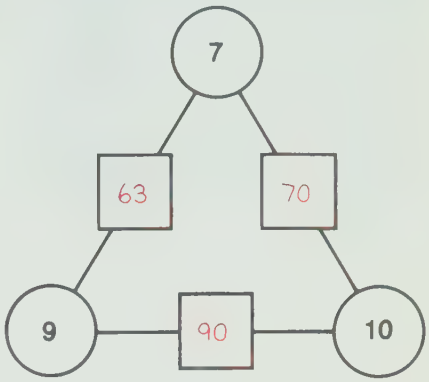
54. Each Family Box holds 3 pieces. How many pieces are in 108 Family Boxes? 324

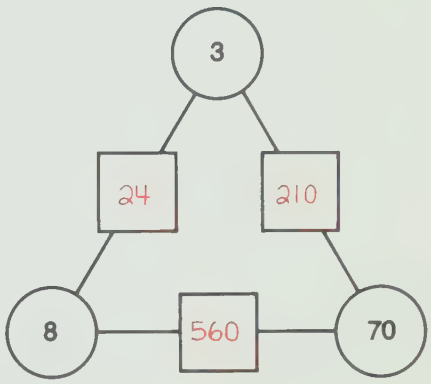
***55.** There are 9 pieces of chicken in each Basket. How many pieces of chicken were sold in Baskets? 756

***56.** There are 2 pieces of chicken in each Lunch Box and Snack Pack. How many pieces were sold in Lunch Boxes and Snack Packs? 336

RELATED ACTIVITIES

- If students helped to prepare a display as suggested in the second activity of *Related Activities* on pages T116-T117, they may now include exercises showing the standard form for examples used at that time.
- Diagrams similar to the following may be used for practicing multiplication (see page T360). Factors are shown in the circles. Products are shown in the squares.





Pages 118-119

LESSON OUTCOME

Multiply an amount of money to $9.99 by a one-digit number; solve related word problems

Prerequisite Skills

Write amounts of money to $9.99 as a number of cents and in dollars-and-cents notation

Checking Prerequisite Skills

Match equal amounts of money.

1.	$0.34 C	A	298¢
2.	$2.98 A	B	5365¢
3.	$4.03 F	C	34¢
4.	$10.00 E	D	6650¢
5.	$53.65 B	E	1000¢
6.	$66.50 D	F	403¢

Multiplying Dollars and Cents

How much will 6 orders of Choice B cost?

Multiply 6 and $1.75.

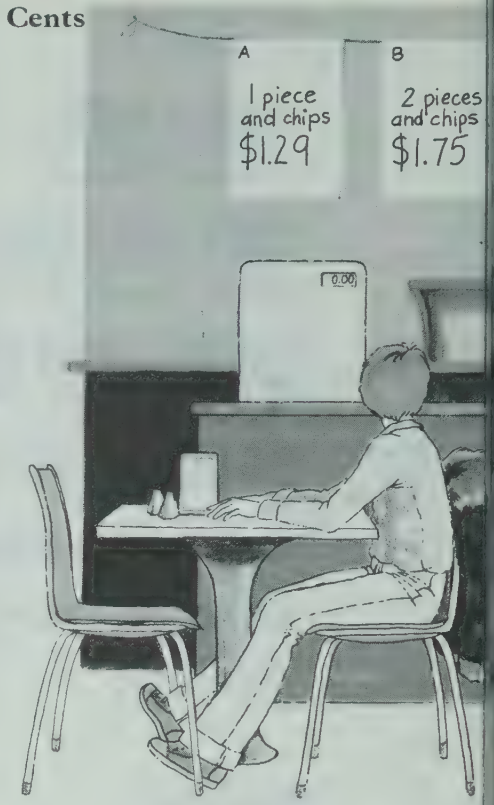
Think $1.75 = 175 cents

Multiply
$$\begin{array}{r} {\scriptstyle 4\ 3} \\ 175 \\ \times\ \ 6 \\ \hline 1050 \end{array}$$

Think 1050 cents = $10.50

The 6 orders will cost $10.50.

Take another look:
$$\begin{array}{r} {\scriptstyle 4\ 3} \\ \$1.75 \\ \times\ \ 6 \\ \hline \$10.50 \end{array}$$



Working Together

Multiply the whole numbers. Use your results to help you multiply the amounts of money.

This product can be shown in dollars and cents.

1. 129 × 2 = 258; $1.29 × 2 = $2.58

2. 371 × 4 = 1484; $3.71 × 4 = $14.84

3. 55 × 7 = 385; 55¢ × 7 = $3.85

Multiply.

4. $5.38 × 7 = $37.66

5. $2.05 × 6 = $12.30

6. $4.40 × 5 = $22.00

7. 75¢ × 4 = $3.00

8. $0.75 × 4 = $3.00

118

LESSON ACTIVITY

Using the Pages

- Have the students study the illustration showing possible choices for fish and chips. Ask what prices are shown for the various choices. Read the statement to introduce the word problem. Discuss that the dot (decimal point) in the numeral separates the dollars from the cents and that there are always two places to the right of the dot. Have a student perform the multiplication aloud to help review the steps of the procedure. Contrast the two solutions given (with the symbols and without the symbols). Summarize that the multiplication can be carried out as with whole numbers.

Working Together: Ex. 1-3 help to establish that multiplying amounts of money is carried out in the same manner as multiplying whole numbers. Thus, emphasis can be given to the skill of placing the decimal point and the symbol $ in their proper positions. Ex. 3 emphasizes the tradition of expressing amounts greater than 99¢ using dollars-and-cents notation. Review that there must be two digits to right of the dot and use other similar examples as requi For Ex. 4-8, some students may prefer to position symbols in the space for the products first and then c out the multiplication.

Exercises: The word problems for Ex. 19-24 relate to illustration. Ex. 23 involves more than one step in solution. Ex. 24 has more than one possible answer.

Assessment

Multiply.

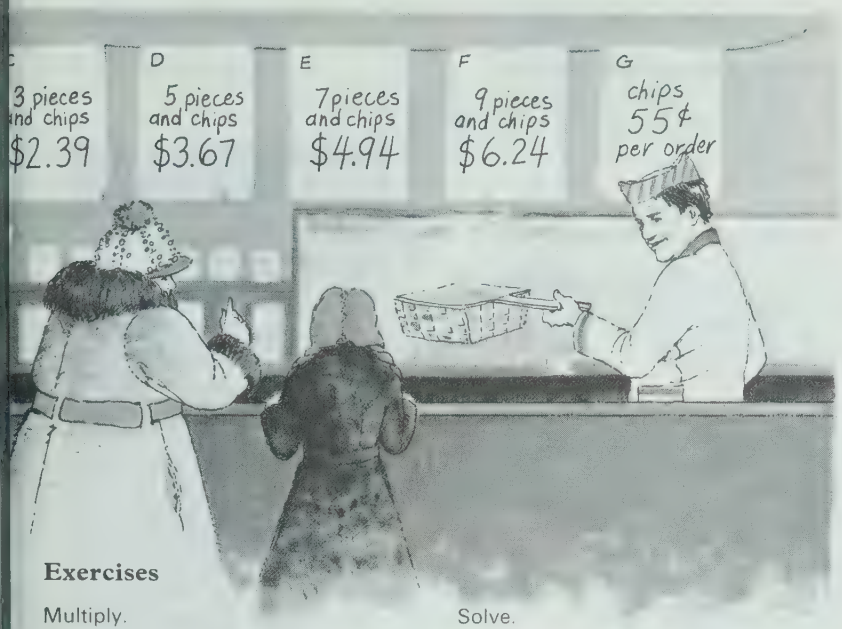
1. $2.34 × 2 = $4.68

2. $5.40 × 6 = $32.40

3. 74¢ × 8 = 592¢ or $5.92

Solve.

4. 55¢ for one order of chips. How much would 7 orders cost? $3.85



Exercises

Multiply.

1. $8.24 × 5 = $41.20
2. $3.27 × 2 = $6.54
3. $6.91 × 7 = $48.37
4. $5.75 × 8 = $46.00
5. $2.67 × 2 = $5.34
6. $9.07 × 4 = $36.28
7. 62¢ × 8 = $4.96
8. $5.63 × 4 = $22.52
9. $2.90 × 9 = $26.10
10. $3.08 × 5 = $15.40
11. 45¢ × 9 = $4.05
12. $5.77 × 3 = $17.31
13. $0.49 × 6 = $2.94
14. $4.44 × 8 = $35.52
15. $3.10 × 5 = $15.50
16. $5.42 × 4 = $21.68
17. $8.09 × 6 = $48.54
18. $9.29 × 2 = $18.58

Solve.

19. How much for 3 orders of Choice A? $3.87
20. How much for 7 orders of Choice D? $25.69
21. How much for 5 orders of Choice E? $24.70
22. Which costs more, 6 orders of Choice C or 9 orders of Choice B? How much more? 9 orders of choice B, $1.41
*23. How much for 2 orders of Choice C, 1 order of Choice D, and 3 orders of chips? $10.10
*24. When ordering fish and chips, which choices would give you 15 pieces of fish? How much would they cost?

24. Answers will vary. Possible answers are 3 orders of Choice D, $11.01; 5 orders of Choice C, $11.95; 2 orders of Choice E and 1 order of Choice A, $11.17.

RELATED ACTIVITIES

- Cutouts of money (dollars, dimes, pennies) from pages T351 and T352 may be helpful in demonstrating products with amounts of money for students having difficulties.
- Some students may be interested in making up word problems about ordering fish and chips for other students to solve.
- Pictures of items cut from newspapers and catalogs marked with prices to $9.99 may be useful in creating word problems similar to those on the pages. Have students pretend to buy up to nine of any item and calculate the cost. You may also wish to have them determine the amount of change they would receive if they paid for the items using a fifty-dollar bill, for example.

Pages 120-121

LESSON OUTCOME

Find the product of three or four one-digit numbers

Materials

a milk bag of the size that would hold 3 pouches (optional)

Prerequisite Skills

Multiply a one-digit, two-digit, and three-digit number by a one-digit number

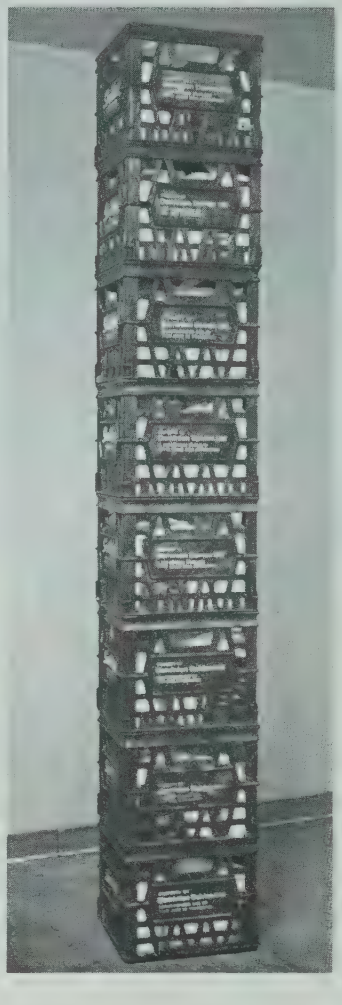
Checking Prerequisite Skills

Multiply.

1. 3 × 7 = 21	**2.** 21 × 6 = 126	**3.** 126 × 4 = 504
4. 8 × 4 = 32	**5.** 32 × 9 = 288	**6.** 288 × 8 = 2304

More Than Two Factors

A case holds 5 large bags of milk.
Each large bag holds 3 pouches.
How many pouches of milk are in 8 cases?



Multiply 3, 5, and 8

like this:

3 — 3 pouches in each large bag
5 — 5 large bags in each case
15 — 15 pouches in each case

4
15 — 15 pouches in each case
8 — 8 cases
120 — 120 pouches in 8 cases

or like this:

8 — 8 cases
5 — 5 large bags in each case
40 — 40 large bags in 8 cases

40 — 40 large bags in 8 cases
3 — 3 pouches in each large bag
120 — 120 pouches in 8 cases

There are 120 pouches of milk in 8 cases.

120

LESSON ACTIVITY

Using the Pages

- The photograph and the word problem present a situation for which it is necessary to find the product of more than two factors, in this case, three factors. The worked example illustrates that the product is the same for two different orders of multiplying the numbers.

  Begin with a discussion of the photograph. Several students may be familiar with the delivery of milk bags by the case to grocery stores. You may arrange to have an example of one such bag in the classroom for this lesson. Ask the students how many milk pouches each bag holds. Then ask what information they would need to know in order to determine how many pouches of milk would be represented in the photograph. This discussion leads to the word problem at the top of page 120.

  Lead the students through the first solution in which 5 and 3 are multiplied first, and that product is multiplied by 8. Summarize that this order leads to the number of pouches in one case first, and then the number in all f 8 cases. If possible, lead the students to suggest an alter order — that of finding the number of large bags for 8 c first (40) and then multiplying by 3 to find the numbe pouches for 40 large bags. Emphasize that for both orc the final product is the same (120).

  You may wish to demonstrate the situation with factors arranged in a horizontal format. Point out that

  8 cases of 5 bags of 3 pouches
  $8 \times 5 \times 3$

  gives

  8 cases of 15 pouches
  $8 \times (5 \times 3)$

  or

  40 bags of 3 pouches
  $(8 \times 5) \times 3$.

Working Together: The situation developed on page presents just one example of the product of three fact Students are naturally skeptical that the products may h been the same by coincidence. Before the students atte

Working Together

Multiply and complete.

1. 5 × 9 × 2 = 45 × 2 = 90 — When the factors are 5, 9, and 2, the product is 90.

2. 2 × 9 × 5 = 18 × 5 = 90 — When the factors are 2, 9, and 5, the product is 90.

3. 8 × 5 × 2 × 6 = 40 × 2 × 6 = 80 × 6 = 480 — When the factors are 8, 5, 2, and 6, the product is 480.

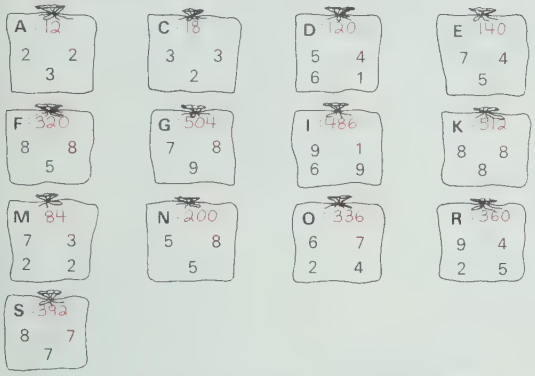
Multiply in one order. Check your work by multiplying in another order.

4. $5 \times 8 \times 4$ 160

5. $8 \times 9 \times 3 \times 2$ 432

Exercises

Multiply the numbers in each bag. Use the matching letters to decode the message.



84 12 512 140 12 18 336 120 140 120
84 140 392 392 12 504 140 320 336 360
12 320 360 486 140 200 120.

MAKE A CODED MESSAGE FOR A FRIEND

1. As I was going to Halifax,
I met a man with 7 sacks.
Each sack had 7 cats.
Each cat had 7 kits.
Man, kits, cats, and sacks, how many were going to Halifax?
the speaker

2. If each pouch of milk holds enough for 3 cats, is there enough milk in eight cases for all the cats in all the sacks?

PROBLEM SOLVING

2 There is milk for 360 cats
There are 49 cats and 343 kits.

121

RELATED ACTIVITIES

- Present students with exercises similar to the following to help them realize that when one of the many factors is zero, the product will be zero. Let them discover for themselves that it is unnecessary to spend time multiplying any of the non-zero factors.

$4 \times 3 \times 0 \times 6$
$0 \times 6 \times 3 \times 5$
$9 \times 7 \times 8 \times 0$
$2 \times 0 \times 8 \times 8$

- Students may play in small groups using 3 or 4 dice marked with a selection of numbers from 0 to 9. Each student, in turn, rolls the dice and finds the product of the numbers shown. Points may be awarded for the greatest and least products obtained.

Ex. 1 and 2, analyze the situation with them. Point out that the same factors, 5, 9, and 2, are multiplied in both Ex. 1 and 2, but that the order of multiplying is different. Ask them if they think the final products will be the same or different. Then have them complete the two exercises and discuss the results. Present the factors in any (or all) of the six possible horizontal arrangements.

$2 \times 9 \times 5$ $5 \times 9 \times 2$ $9 \times 5 \times 2$
$2 \times 5 \times 9$ $5 \times 2 \times 9$ $9 \times 2 \times 5$

Point out that the product is the same no matter which two factors are multiplied first.

$(2 \times 9) \times 5 = 2 \times (9 \times 5)$, and so on.

Use similar exercises as needed. You may wish to have students verbalize their understanding of the idea involved in summarizing that the order of multiplying factors does not affect the product. However, it probably is not necessary to use the term "associative property" with the students at this time.

You may wish to have students repeat Ex. 3 using a different order of their own choosing, and compare the results. Ex. 4 and 5 point out that multiplying in a different order is one way of checking a product.

Exercises: The products obtained in these exercises help to decode the message at the bottom of page 121. Clarify the procedure, if necessary. After the students decode the message, you may wish to discuss some of the different orders that were used to multiply the numbers for a few of the exercises.

Problem Solving: The first exercise may provoke a discussion when students learn that 343, the product of $7 \times 7 \times 7$, is not the answer to the problem. The problem assumes that the traveller, who is on the way to Halifax, meets the man with the cats who is coming from the direction of Halifax.

To answer Ex. 2, the students will need to refer to the example developed on page 120.

Assessment

Multiply.

1. $4 \times 6 \times 5$ 120
2. $8 \times 3 \times 7$ 168
3. $9 \times 9 \times 9 \times 9$ 6561

Page 122

LESSON OUTCOME

Simplify a number expression involving more than one operation by first completing the operation shown in parentheses

Vocabulary

operation

Prerequisite Skills

Add and subtract with regrouping; multiply by a one-digit number

Checking Prerequisite Skills

Add.

1. 643
179
822

2. 1200
634
566

Multiply.

3. 58
7
406

4. 163
8
1304

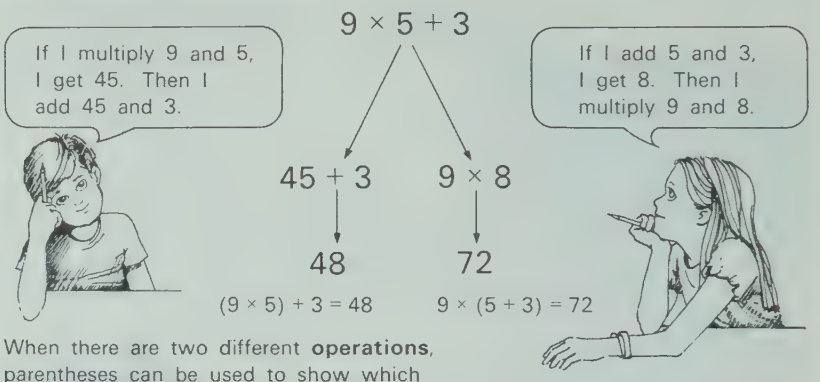
RELATED ACTIVITIES

- You may wish to prepare a work sheet with exercises similar to the following. Have students place parentheses in each sentence to show which operation must be performed first to obtain the indicated result.

1. $(45 \times 2) + 6 = 96$
2. $138 - (17 \times 7) = 19$
3. $(16 + 224) \times 3 = 720$

Multiplication, Addition, and Subtraction Together

What is the result for $9 \times 5 + 3$?



When there are two different **operations**, parentheses can be used to show which operation is to be done first.

Working Together

Work inside the parentheses first.

1. $(2 \times 3) + 4$ 10 **2.** $5 \times (8 - 7)$ 5 **3.** $(7 + 9) \times 8$ 128

Are two different results possible?
If so, use parentheses to show how.

4. $8 \times 6 + 1$ $(8 \times 6) + 1 = 49$, $8 \times (6 + 1) = 56$ **5.** $15 - 3 \times 4$ $(15 - 3) \times 4 = 48$, $15 - (3 \times 4) = 3$ **6.** $26 + 18 \times 5$ $(26 + 18) \times 5 =$, $26 + (18 \times 5) =$

Exercises

Are two different results possible?
If so, use parentheses to show how.

1. $29 \times 9 - 4$ **2.** $38 \times 3 + 5$ **3.** $12 + 43 \times 7$

Work inside the parentheses first.

4. $(43 + 77) \times 2$ 240 **5.** $(400 - 227) \times 6$ 1038 **6.** $(85 \times 3) - 166$ 89
7. $192 \times (9 - 2)$ 1344 **8.** $68 \times (1 + 5)$ 408 **9.** $716 \div (15 \times 0)$ 716
10. $1000 - (387 \times 2)$ 226 **11.** $58 \times (360 - 359)$ 58 **12.** $(123 \times 9) + 893$ 2000
13. $(506 \times 4) - 1376$ 648 **14.** $(75 + 592) \times 2$ 1334 **15.** $(1100 - 293) \times 4$ 3228
16. $80 \times (0 + 8)$ 640 **17.** $(777 \times 7) + 1665$ 7104 **18.** $35 + (339 \times 5)$ 1730

122 1. $(29 \times 9) - 4 = 257$, $29 \times (9 - 4) = 145$ 2. $(38 \times 3) + 5 = 119$, $38 \times (3 + 5) = 304$ 3. $(12 + 43) \times 7 = 385$, $12 + (43 \times 7) = 313$

LESSON ACTIVITY

Using the Page

- The worked example illustrates the need to reach an agreement for simplifying a number expression that involves two different operations. At this time, the agreement is to use parentheses to show which operation is to be performed first. A similar situation was first encountered on page 71 of Unit 3.

  Discuss the two methods shown for simplifying $9 \times 5 + 3$, introducing the word *operations*. Discuss that $(9 \times 5) + 3$ is a name for 48, whereas $9 \times (5 + 3)$ is a name for 72. Review that parentheses indicate which operation is to be performed first and thus establish which number is being named.

Working Together: Ex. 1-3 establish the procedure of working inside the parentheses first. Ex. 4-6 emphasize that a number expression can name two different numbers, depending upon which operation is shown in parentheses.

Students are required to show the two possibilities for e exercise.

Exercises: Have the students work independently. When t have finished, you may wish to ask them which exer would give 0 as the result if the parentheses were chan (Ex. 9). Discuss that it would be unnecessary to 716 and 15 if the sum is eventually to be multiplied by z

Assessment

Work inside the parentheses first.

1. $(4 \times 326) + 116$ 1420
2. $(417 - 138) \times 5$ 1395
3. $160 \times (6 - 3)$ 480

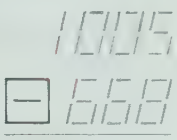
Practice

Add, subtract, or multiply.

1. 5×39 195	2. 3×968 2904	3. $197 + 8$ 205	4. $304 - 54$ 250
5. $594 + 754$ 1348	6. 9×76 684	7. $2184 - 726$ 1458	8. $3726 + 2974$ 6700
9. 8×364 2912	10. 7×46 322	11. $6026 - 2458$ 3568	12. 2×95 190
13. $988 + 3816$ 4804	14. $102 - 13$ 89	15. 4×596 2384	16. 6×256 1536
17. $81 - 58$ 23	18. 8×98 784	19. $947 + 985$ 1932	20. 7×158 1106
21. $(6 \times 287) + 288$ 2010	22. $3020 - (382 + 1708)$ 930	23. $(5 \times 495) - 500$ 1975
24. $2200 - (4104 - 2208)$ 304	25. $(234 - 225) \times 234$ 2106	26. $4000 - (4 \times 794)$ 824

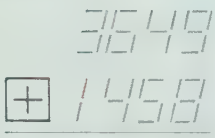
Lee, Sol, Lois, and Les did these exercises on a calculator. What did the calculator show for each?

27. 337



28. 705

29. 5107



30. 537

Calculator digits can help you solve this riddle.

31. Riddle: What did Solomon Snake say when asked whether the calculator belonged to Lois or Les?

Hint:

Riddle: hiss (hISS)

LESSON ACTIVITY

Using the Page

These exercises provide more practice with the skills presented in the previous lesson. Ex. 31 suggests that some digits on the calculator are similar to certain letters of the alphabet. For this exercise, students will need to turn the paper showing the product through a turn of 180°. The numeral 5514 will appear as the letters hISS.

OBJECTIVE

Demonstrate competence in addition, subtraction, and multiplication when simplifying expressions with and without parentheses

RELATED ACTIVITIES

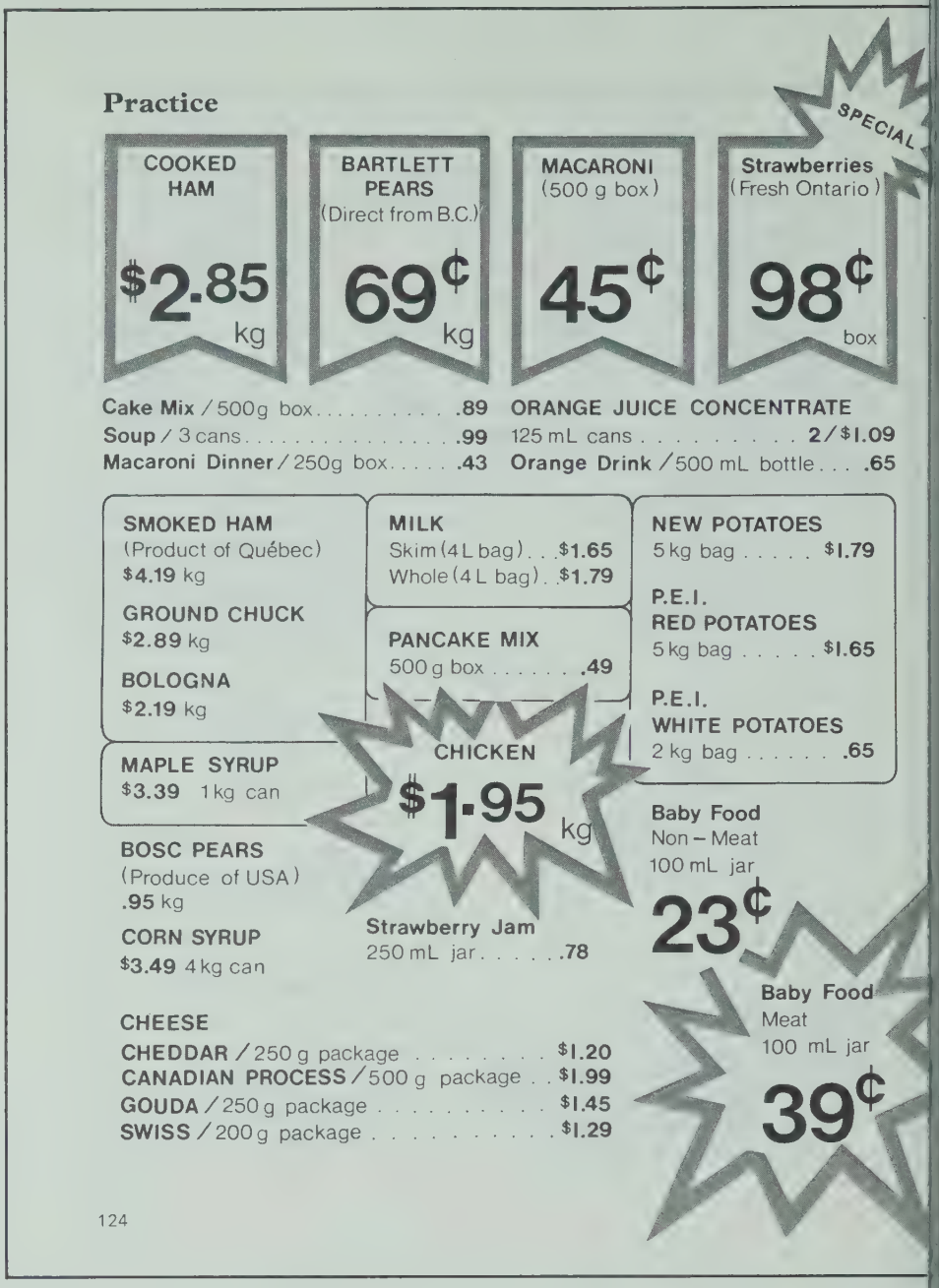
• To provide further practice, prepare a device similar to the one illustrated. Use three circular shapes and a suitable fastener to attach them at their centres so that the shapes may turn. Mark the shapes with a selection of numbers as shown. Several exercises may be determined from one position. The shapes may be turned to present a new set of exercises. The smallest circular shape may be exchanged for another to show a different factor. The exercise may involve one or more operations, depending on the specifications given when assigning the work.

$6 \times 9 \times 8$
or $6 + (9 \times 8)$
or $(6 \times 9) + 8$

Pages 124-125

OBJECTIVE

Demonstrate competence in multiplication



LESSON ACTIVITY

Using the Pages

- Purchasing items in a grocery store offers an everyday application of multiplication. Have the students study page 124. Ask questions to familiarize them with the items described on the page.

  "How much does a jar of strawberry jam cost?"
  "What size is the jar?"
  "Which kind of cheese do you prefer?"
  "What is the price of your favorite kind of cheese?"
  "How much cheese do you get for that amount?"
  "Is one dollar enough money to buy two boxes of pancake mix?"

  Give the students an opportunity to ask questions about terms and vocabulary not familiar to them. Explain that for items such as the smoked ham, $4.19 kg means the cost is four dollars and nineteen cents for each kilogram of ham. If necessary, review the meanings of the symbols g, kg, L, and mL.

- You may wish to work one or two of Ex. 1-16 with students to ensure that they understand the proced Remind them that for an example such as Ex. 7, the pro should be written using dollars-and-cents notation. 13-15 are starred as their solutions involve more than step. Ex. 16 is starred as there are several possible answ depending on the selection of baby foods (non-mea meat).

Problem Solving: These exercises provide further practice at the same time, suggest the need to be aware of chec the prices of items as they appear on cash register tap

Use information from the advertisement to help you find the cost for each of these.

1. a 3 kg smoked ham $12.57
2. 2 kg of B.C. pears $1.38
3. 4 kg of bologna $8.76
4. 4 kg of maple syrup $13.56
5. 3 boxes of pancake mix $1.47
6. 3 jars of strawberry jam $2.34
7. 5 boxes of macaroni dinner $2.15
8. 4 bags of skim milk $6.60
9. 2 packages of Canadian cheese $3.98
10. 4 boxes of strawberries $3.92
11. 5 bottles of orange drink $3.25
12. 3 boxes of cake mix $2.67

*13. 9 cans of soup $2.97

*14. 8 cans of orange juice $4.36

*15. 2 bags of red potatoes and 5 bags of white potatoes $6.55

*16. 9 jars of baby food
If meat, $3.51; if non-meat, $2.07

Multiply.

17. 146 × 7 = 1022	18. 872 × 4 = 3488	19. 508 × 8 = 4064
20. $5.97 × 2 = $11.94	21. $2.68 × 3 = $8.04	22. $0.67 × 6 = $4.02
23. 830 × 5 = 4150	24. 478 × 9 = 4302	25. 649 × 5 = 3245
26. $2.09 × 8 = $16.72	27. $1.95 × 6 = $11.70	28. $3.80 × 7 = $26.60
29. 694 × 4 = 2776	30. 473 × 3 = 1419	31. 318 × 6 = 1908

Mr. Burton made this shopping list from the advertisement.

GROCERY LIST

3 cans soup
2 bags whole milk
Bartlett pears - 1 kg
2 kg ground chuck
Macaroni dinner - 1

He bought everything that he had listed. Here is his cash register tape.

THANK YOU

Milk.....	1.79
Fruit...1 kg @ 0.69	
.....	0.69
Meat....2 kg @ 2.98	
.....	5.96
Grocery.....	0.99
Grocery.....	0.43
Milk.....	1.65
Total.....	11.51

COME AGAIN

1. What mistakes can you find on the tape?
2. What should the total be? 11.47

PROBLEM SOLVING

1. The meat should be 2 kg @ 2.89, or 5.78. The second entry for milk should be 1.79.

RELATED ACTIVITIES

- Some students may be interested in preparing shopping lists using information on page 124. Other students may find the total cost of the items on the lists.

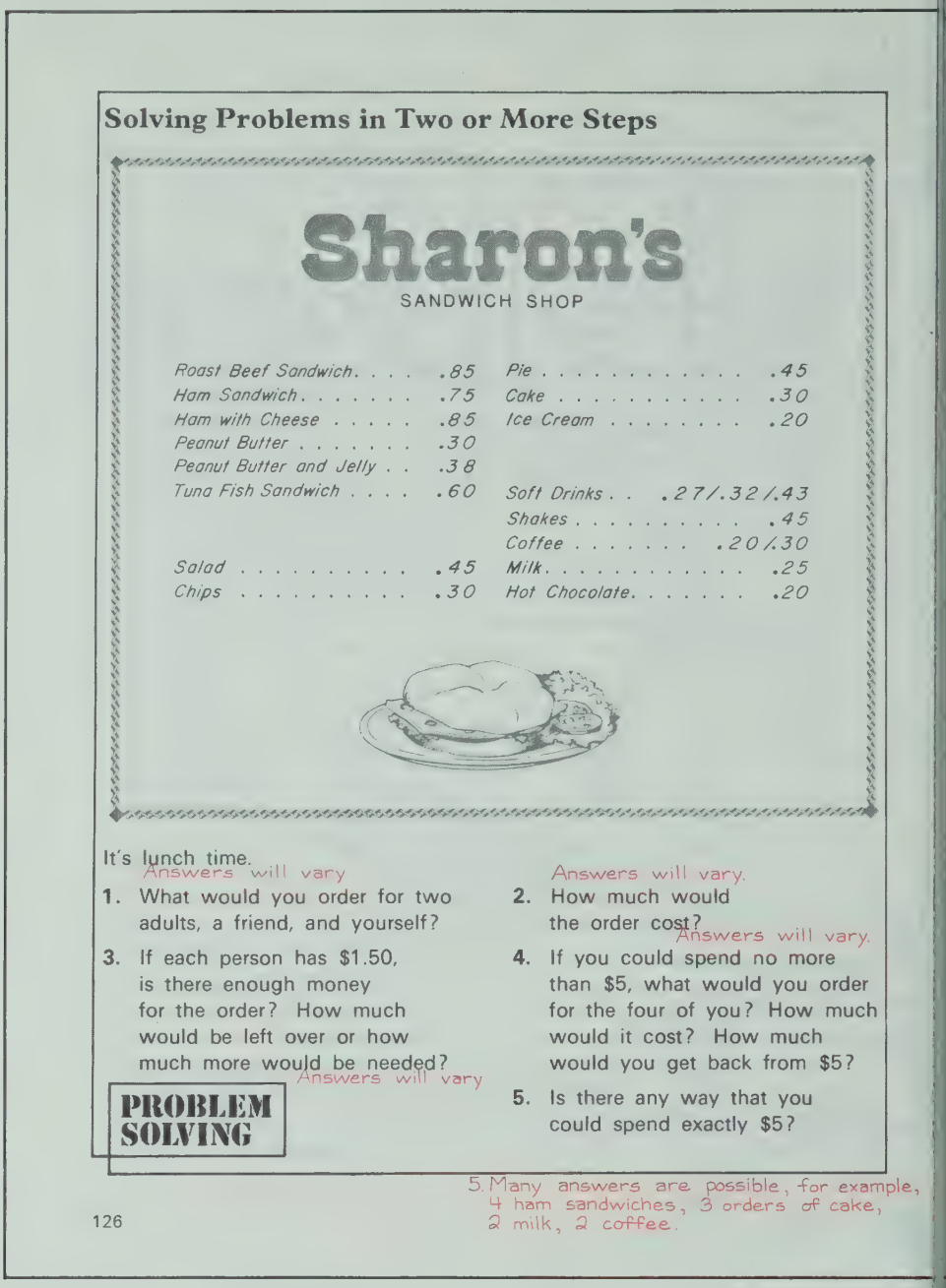
Page 126

OBJECTIVE

Solve word problems involving two or more steps

RELATED ACTIVITIES

- Since the selections from the menu are left up to each student individually, you may wish to display some of their work to show the different choices that were made and the calculations that were involved.
- Some students may be interested in bringing to school copies of menus from local restaurants and using these to create and solve word problems.



Solving Problems in Two or More Steps

Sharon's
SANDWICH SHOP

Roast Beef Sandwich	.85	Pie	.45
Ham Sandwich	.75	Cake	.30
Ham with Cheese	.85	Ice Cream	.20
Peanut Butter	.30		
Peanut Butter and Jelly	.38		
Tuna Fish Sandwich	.60	Soft Drinks	.27/.32/.43
		Shakes	.45
		Coffee	.20/.30
Salad	.45	Milk	.25
Chips	.30	Hot Chocolate	.20

It's lunch time.

1. What would you order for two adults, a friend, and yourself? Answers will vary
2. How much would the order cost? Answers will vary.
3. If each person has $1.50, is there enough money for the order? How much would be left over or how much more would be needed? Answers will vary
4. If you could spend no more than $5, what would you order for the four of you? How much would it cost? How much would you get back from $5? Answers will vary.
5. Is there any way that you could spend exactly $5?

PROBLEM SOLVING

5. Many answers are possible, for example, 4 ham sandwiches, 3 orders of cake, 2 milk, 2 coffee.

126

LESSON ACTIVITY

Using the Page

- Have the students study the menu illustrated. Ensure that they recognize the words listed. Discuss that prices shown as .27/.32/.43 imply that three sizes are available for that item.

  Read Ex. 1. Suggest that the students organize their work by listing the choices for each person, in turn, in a column with the corresponding prices at the right. You may even wish to prepare copies of a restaurant order form of the type used by waiters and waitresses and have the students use these, one for each order.

Sharon's Sandwich Shop	
Item	Cost
Please pay.	
Thank you.	

Have the students continue with the remaining exerc s. You may wish to have them exchange papers to check another's computations. Review orally the main steps a were used to solve the problems.

Checking Up

Multiply.

1. 2 × 3 = 6	2. 9 × 1 = 9	3. 0 × 8 = 0	4. 5 × 4 = 20	5. 9 × 5 = 45	6. 7 × 6 = 42
7. 30 × 2 = 60	8. 10 × 8 = 80	9. 200 × 4 = 800	10. 50 × 3 = 150	11. 600 × 7 = 4200	12. $400 × 5 = $2000
13. 14 × 2 = 28	14. 21 × 4 = 84	15. 91 × 7 = 637	16. 24 × 3 = 72	17. 88 × 6 = 528	18. 72 × 8 = 576
19. 231 × 3 = 693	20. 323 × 2 = 646	21. 831 × 2 = 1662	22. 601 × 6 = 3606	23. 219 × 3 = 657	24. $130 × 5 = $650
25. 187 × 9 = 1683	26. 818 × 4 = 3272	27. 850 × 8 = 6800	28. 136 × 6 = 816	29. 507 × 2 = 1014	30. 361 × 9 = 3249
31. 336 × 4 = 1344	32. 745 × 7 = 5215	33. 594 × 9 = 5346	34. $2.80 × 7 = $19.60	35. $7.06 × 5 = $35.30	36. $4.59 × 6 = $27.54

Complete.

37. 2 × ▢ = 16 8	38. ▢ × 3 = 15 5	39. 3 × ▢ = 24 8
40. ▢ × 8 = 0 0	41. 9 × ▢ = 9 1	42. ▢ × 7 = 56 8

Find the result.

43. 4 × 1 × 4 16	44. 5 × 7 × 2 × 3 210	45. 3 × 2 × 3 × 2 36
46. 2 × 9 × 2 36	47. 6 × 6 × 4 144	48. 9 × 9 × 9 × 0 0
49. 3 × (5 + 4) 27	50. (41 − 37) × 16 64	51. 155 + (7 × 135) 1100
52. (5 × 65) − 65 260	53. 120 − (8 × 12) 24	54. (6 × 30) + 36 216

Solve.

55. 45 cookies in a package. How many in 6 packages? 270

56. 144 cans in a carton. How many cans in 7 cartons? 1008

57. 59¢ for a hamburger. How much for 3 hamburgers? $1.77

58. 36 pieces of chicken in a tub. How many pieces in 7 tubs? 252

59. Each bag of potatoes costs $1.65. How much for 5 bags? $8.25

60. One kilogram of ham costs $4.19. How much for 3 kg? $12.57

127

Page 127

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Have small groups of students play the following game using three dice marked: 0, 1, 2, 3, 4, 5; 4, 5, 6, 7, 8, 9; 0, 2, 3, 7, 8, 9. Have each student, in turn, roll the dice and find the product of the three numbers shown. After five rounds each student finds the sum of her/his products. The student with the greatest sum wins.
- Prepare a work sheet of exercises similar to the following. Have students write the operation symbols to complete the sentences. Choose any two of +, −, and × to complete each sentence so that the statement is true.

1. (9 ◯ 6) ◯ 3 = 9 − ×
2. 4 ◯ (5 ◯ 2) = 28 × +
3. (12 ◯ 3) ◯ 6 = 30 × −

lls	Exercises	Related Pages
mplete basic multiplication facts	1-6	T 102-T 105
ltiply a multiple of ten by a ne-digit number	7,8,10	T 114-T 115
ltiply a multiple of one hundred y a one-digit number	9,11,12	T 118-T 119
ltiply a two-digit number or a hree-digit number by a one-digit umber, using standard form	13-33	T 122-T 123
ltiply an amount of money o $9.99 by a one-digit number	34-36	T 126-T 127
termine the missing factor to complete a multiplication fact	37-42	T 110-T 111
d the product of three or four ne-digit numbers	43-48	T 128-T 129
plify number expressions nvolving parentheses	49-54	T 130
ve multiplication problems	55-60	

Comments

Determine whether errors in Ex. 13-36 are caused by forgetting basic multiplication facts or by incorrect regrouping. Also, some students may inadvertently add the regrouped tens, for example, before they multiply the tens. Reteach as needed and provide more practice for reinforcement, drawing upon the various activities and games suggested throughout the unit.

Unit 6 Overview

Division

This unit explores the meaning and operation of division from two points of view. It begins with the *partitive*, or sharing, concept in which the number of equal groups is known and is the divisor. Toward the end of the unit the *quotitive*, or measurement, concept is presented in which the size of the equal groups is known and, therefore, is the divisor. Arrays are used to relate multiplication and division, and basic multiplication facts are used extensively in finding quotients. Multiples of ten are divided by naming dividends in terms of tens and by using basic facts. The standard algorithm is presented in its fullest form when division with remainders is introduced. The unit concludes with the use of equations in solving word problems.

Prerequisite Skills

- subtract with regrouping
- complete the basic multiplication facts
- multiply a multiple of ten by a one-digit number

Unit Outcomes

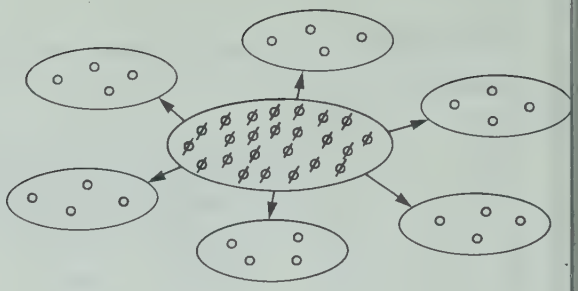
- associate division with forming equal shares; find the number in each group when the number of groups is known (partitive division)
- use an array to help find a quotient
- use a multiplication fact to check a division
- write the family of multiplication and division facts for three given numbers, using arrays
- use the multiplication table to help complete division facts
- use multiplication to divide; solve related word problems
- associate division with finding the number of equal groups (quotitive, or measurement, division); use division to find the number of equal groups
- divide a multiple of ten by a one-digit number, quotients to 90 (remainder zero)
- find the quotient and the remainder, divisors and quotients to 9
- write an equation to match a word problem

Background

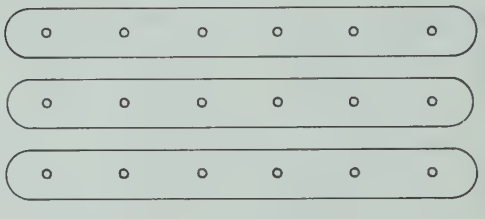
There are two concepts with respect to the operation of division. In partitive, or sharing, division, the divisor represents the number of groups; in quotitive, or measurement, division, the divisor represents the size of each group. An abstract division fact such as $24 \div 6 = 4$ or $6\overline{)24}$ does not indicate either of these two concepts. It is only in the context of forming groups or in problem situations drawn from real life that these can be distinguished.

In the partitive sense, $6\overline{)24}$ means that 24 is divided into 6 equal parts and the quotient 4 indicates the size of each part (A). In the quotitive sense, 24 is divided into groups of 6 and the quotient 4 indicates the number of groups; in other words, 24 is measured in sixes (B). In this book, the approach to the algorithm for long division utilizes the concept of sharing the dividend place by place (see the Overview for Unit 11 on pages T 268 and T 269). For this reason, greater attention is directed at this time to the partitive aspect of division.

A



B



The development in this unit emphasizes the inv relationship between multiplication and division. What operation "does", the other "undoes", and thus, basic fact each operation are also related. For example, the followi one family of related basic facts.

$3 \times 5 = 15$ $\quad$ $15 \div 3 = 5$
$5 \times 3 = 15$ $\quad$ $15 \div 5 = 3$

In the Overview for Unit 5 it is pointed out that b multiplication facts are those which have one-digit fac Therefore, basic division facts are those which have one- divisors and one-digit quotients. Note that while $6 \times 0 = 0$ $0 \times 6 = 0$ have meaning, $6 \div 0$ has no meaning, $0 \div 6 = 0$ is better left until a later level. All the other non- division facts should be related to multiplication facts so students may acquire mastery of the facts in both operations a minimum of effort.

The inverse relationship between the two operations is use determine quotients in division. For example, for $7\overline{)35}$, one think of $\square \times 7 = 35$ or $7 \times \square = 35$. The missing fa in the multiplication sentences is the same as the mis quotient in the division. This thought process is used extensi in performing the operation of division and particularly w recording the steps in the algorithm. It should be pointed out in cases where the division leaves a remainder, the link between the actual division and the basic multiplication fac not so clear-cut. For example, for $6\overline{)27}$ there are no b multiplication facts for 6 with the product 27. Facts with 6 factor which relate most closely to the division are $6 \times 4 =$ and $6 \times 5 = 30$, and only the former can be used since product is less than the dividend 27.

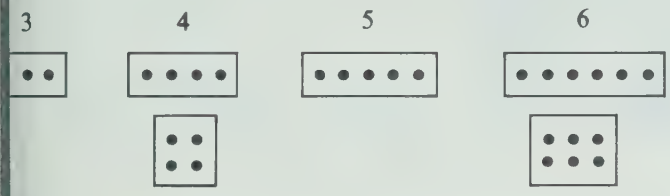
The standard algorithm for division involves two operation succession — multiplication and subtraction. The first rec multiples of the divisor and the second subtracts them to re any remainder. The second step also emphasizes a relation between division and subtraction. Just as multiplicatio related to repeated addition of the same number, so divisio related to repeated subtraction of the same number. measurement division, $8\overline{)35}$ asks the question, "How many are in 35?" This can be found by subtracting 8's, one at a t (C), or several at one time (D). This also occurs in the stand algorithm (E). In each case, the quotient is 4 and the remai is 3.

C
$$\begin{array}{rl} 35 & \\ -\ 8 & 1 \\ \hline 27 & \\ -\ 8 & 1 \\ \hline 19 & \\ -\ 8 & 1 \\ \hline 11 & \\ -\ 8 & 1 \\ \hline 3 & 4 \end{array}$$

D
$$\begin{array}{rl} 35 & \\ -\ 32 & (4 \times 8) \\ \hline 3 & \end{array}$$

E
$$8\overline{)35} \quad 4\ \text{R}3$$
$$\underline{32}$$
$$3$$

On page 145 the *Try This* feature introduces *prime numbers* as se that have only two factors, one of which is always 1. mbers that have more than two factors are known as *mposite numbers*. Thus, the number one is not a prime mber, and the first prime number is two. It is interesting to e that rectangular arrays to represent prime numbers have y a single row (or column), while arrays for composite mbers can be arranged in more than one way. From the arrays wn here, it can be seen that 3 and 5 are prime numbers, and 4 6 are composite numbers.



One approach to solving word problems makes use of ations to show the relationships between the numbers olved. When the unknown is found to make the equation a e statement, the problem is solved. Sometimes the equation is ctured in a manner which leads directly to its solution, as in ÷ 9 = ▒ . At other times, the relationship between the wn numbers may be expressed in such a way that a new ation using an inverse operation is needed; for example, + ▒ = 53 needs to be rewritten as 53 − 16 = ▒ . hough different people may see the relationships in different ys and may structure different equations, the solutions are lly achieved in the same manner. For example, "John had hockey cards. After winning some in a game with his friend, found he had 42 cards. How many cards did he win?" The n sentence 25 + ▒ = 42 structures the event in the order manner in which it occurred, but the solution requires the of subtraction which is indicated in 42 − 25 = ▒ . A re perceptive individual might perceive this as a subtractive ation and start immediately with the open subtraction tence. In both cases, this is the step which leads directly to solution.

Teaching Strategies

Counters of various types, such as buttons, tickets, pebbles, beans, and sticks, should be readily available for students. Such materials enable students to have direct experience with both the sharing and the measurement aspects of division. Also, they need opportunities to write families of related facts for prepared arrays, and the reverse procedure of making arrays to represent families of related facts. Pegboards and pegs are particularly useful in this connection because the arrays can be changed quickly.

$4 \times 2 = 8$	• • • •	$8 \div 4 = 2$
$2 \times 4 = 8$	• • • •	$8 \div 2 = 4$

As the students work with division facts and multiplication facts, they should be acquiring some mastery of them. This should be encouraged and it is suggested that records be kept of students' mastery and needs. If the facts are organized on the basis of the second factor in multiplication and all the related facts are dealt with together, those which are known and those which are not can be easily identified. For example, facts for the factor 7 would begin as shown.

$\boxed{1 \times 7 = 7}$	$\boxed{2 \times 7 = 14}$	$\boxed{3 \times 7 = 21}$
$7 \times 1 = 7$	$7 \times 2 = 14$	$7 \times 3 = 21$
$7 \div 1 = 7$	$14 \div 2 = 7$	$21 \div 3 = 7$
$7 \div 7 = 1$	$14 \div 7 = 2$	$21 \div 7 = 3$

According to common needs, students should be grouped for practice activities using games and devices suggested in lesson outlines and in *Related Activities*.

Materials

various counters, elevator beads (see page T 344)
models for tens and hundreds

Vocabulary

division	division fact
divided by	basic division fact
quotient	prime number
remainder	equation

Pages 128-129

LESSON OUTCOME

Associate division with forming equal shares; find the number in each group when the number of groups is known (partitive division)

Materials

counters

Vocabulary

division, division fact, divided by, ÷, $\overline{)}$

6 DIVISION

Sharing

Wendy has 20 buttons to share among 5 friends.
She gives one to each . . .

. . . then another . . .

. . . and another . . .

. . and another . . .

. . . until all the buttons are given away.

When 20 are shared among 5, each gets 4.

This is shown by the division fact

$20 \div 5 = 4$

or

$$5\overline{)20}\ 4$$

20 divided by 5 equals 4.

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LESSON ACTIVITY

Before Using the Pages

- Review the concept of equal sharing with the students. Have them sit in groups of three or four and share a number of counters equally to find how many each will get. Select the number of counters each time so that there is no remainder.

Using the Pages

- The example presents a sharing situation similar to the ones the students will have experienced in the preliminary activities. Lead the students through the sequence of photographs, emphasizing that the sharing process continues until all the buttons are given away. Develop that a *division fact* can show a sharing situation. Point out both forms for writing the division fact; that is, using the symbol ÷ and the symbol $\overline{)}$.

Working Together: The steps developed in Ex. 1-4 represent a sharing process to find the quotient for fifteen divided by three. This procedure may be used to find other divi facts that are unknown or that cannot be recalled. For 2, point out that the sharing is shown by crossing out circles in the first group as they are shared and drawn in new groups. For Ex. 4, emphasize the role of each num in the division fact.

15	÷	3	=	5
number in all		number of groups		numbe each gr

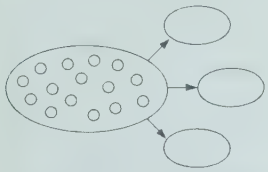
$$\text{number of groups}\ \overline{)\ \text{number in all}}\ \text{number in each group}$$

For Ex. 5, have the students follow the steps as outlined Ex. 1-4. The concept of division is seen in four diffe ways in Ex. 6-9.

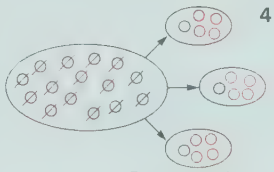
Exercises: By requiring diagrams for Ex. 5-10, the concept division as equal sharing is reinforced. To familiarize students with the symbols and vocabulary of division, h

Working Together

1. 15 buttons to share in 3 equal groups. Copy the picture.



2. Show the sharing like this. Complete the picture.



3. How many are in each group? 5

4. Complete.

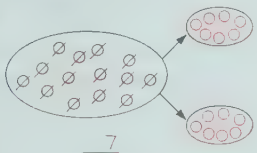
$15 \div 3 = 5$

$3\overline{)15}$ 5

Complete the picture and the division fact.

Draw a picture and give the division fact for each.

5.

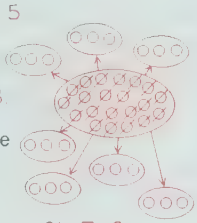


$2\overline{)14}$ 7

6. 12 buttons shared equally among 4

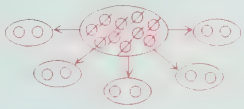
7. 18 divided by 3

8. $21 \div 7$



$21 \div 7 = 3$

9. $5\overline{)10}$

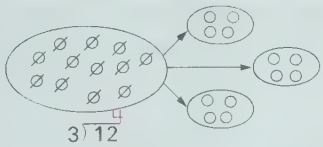


$10 \div 5 = 2$

Exercises

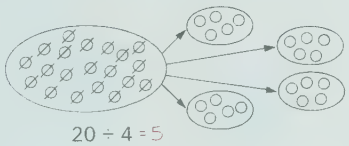
Complete the division fact for each picture.

1.



$3\overline{)12}$ 4

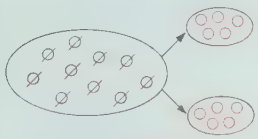
2.



$20 \div 4 = 5$

Complete each picture and the division fact.

3.



$10 \div 2 = 5$

4.

$6\overline{)18}$ 3

Draw a picture and write the division fact for each.

5. $9 \div 3$ 6. $12 \div 2$ 7. $5\overline{)15}$ 8. $4\overline{)16}$ 9. $6\overline{)24}$ 10. $8\overline{)24}$

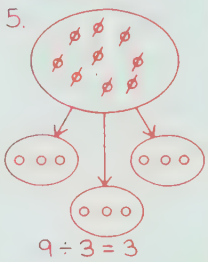
Answers for Ex. 5–10 are given below.

RELATED ACTIVITIES

- Have students suggest occasions for which equal sharing takes place, for example, sharing cards for certain card games. List the suggestions and display them for a few days.
- Prepare several containers of buttons. Label the containers to show the number of buttons and the number of students who are to share. Have students work in groups to share the buttons and write the corresponding division facts using two forms (÷ and $\overline{)}$). The buttons may be returned to the containers for other students to use.
- The above activity may be adapted for students to work alone. The buttons may be placed into sections of egg cartons as they are shared.

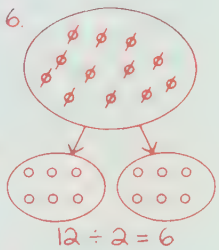
Exercises

5.



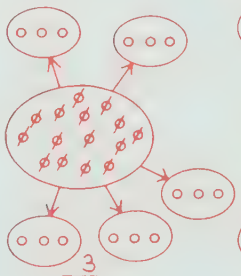
$9 \div 3 = 3$

6.



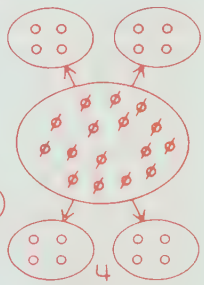
$12 \div 2 = 6$

7.



$5\overline{)15}$ 3

8.

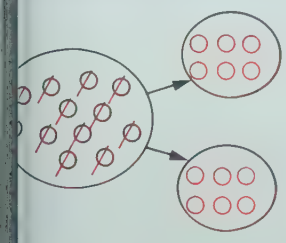


$4\overline{)16}$ 4

each of several students read the division facts aloud for these exercises and interpret each in terms of sharing. For example, for Ex. 4, the response would be, "Eighteen shared equally by six gives three to each. Eighteen divided by six equals three."

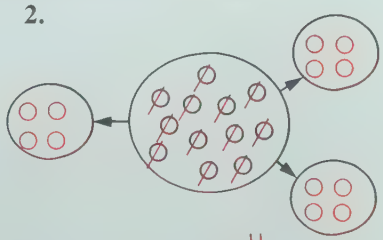
ssessment

mplete each picture and the division fact.



$12 \div 2 = 6$

2.

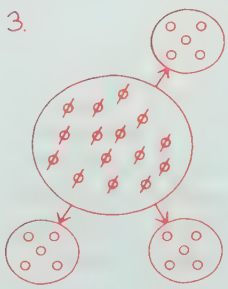


$3\overline{)12}$ 4

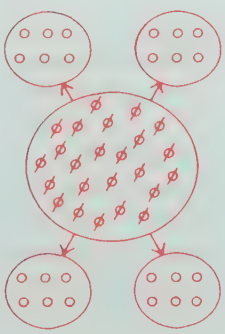
aw a picture and write the division fact for each.

3. $15 \div 3 = 5$ 4. $4\overline{)24}$ 6

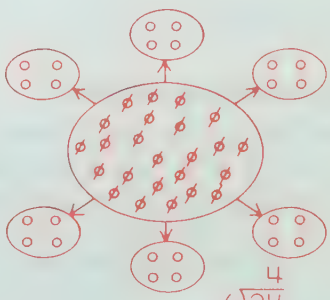
3.



4.

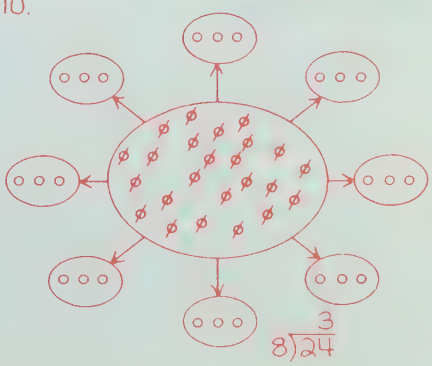


9.



$6\overline{)24}$ 4

10.



$8\overline{)24}$ 3

Pages 130-131

LESSON OUTCOME

Use an array to help find a quotient; use a multiplication fact to check a division

Materials

12 counters or other objects

Vocabulary

quotient

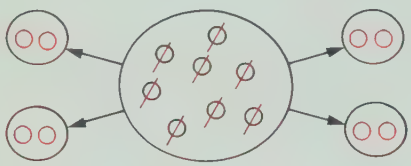
Prerequisite Skills

Find the number in each of equal groups

Checking Prerequisite Skills

Complete the picture and the division fact.

1.

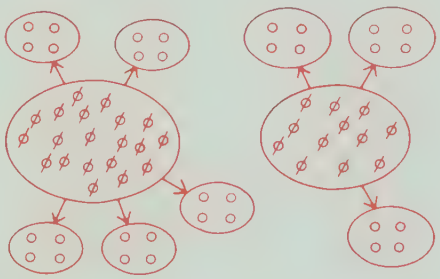


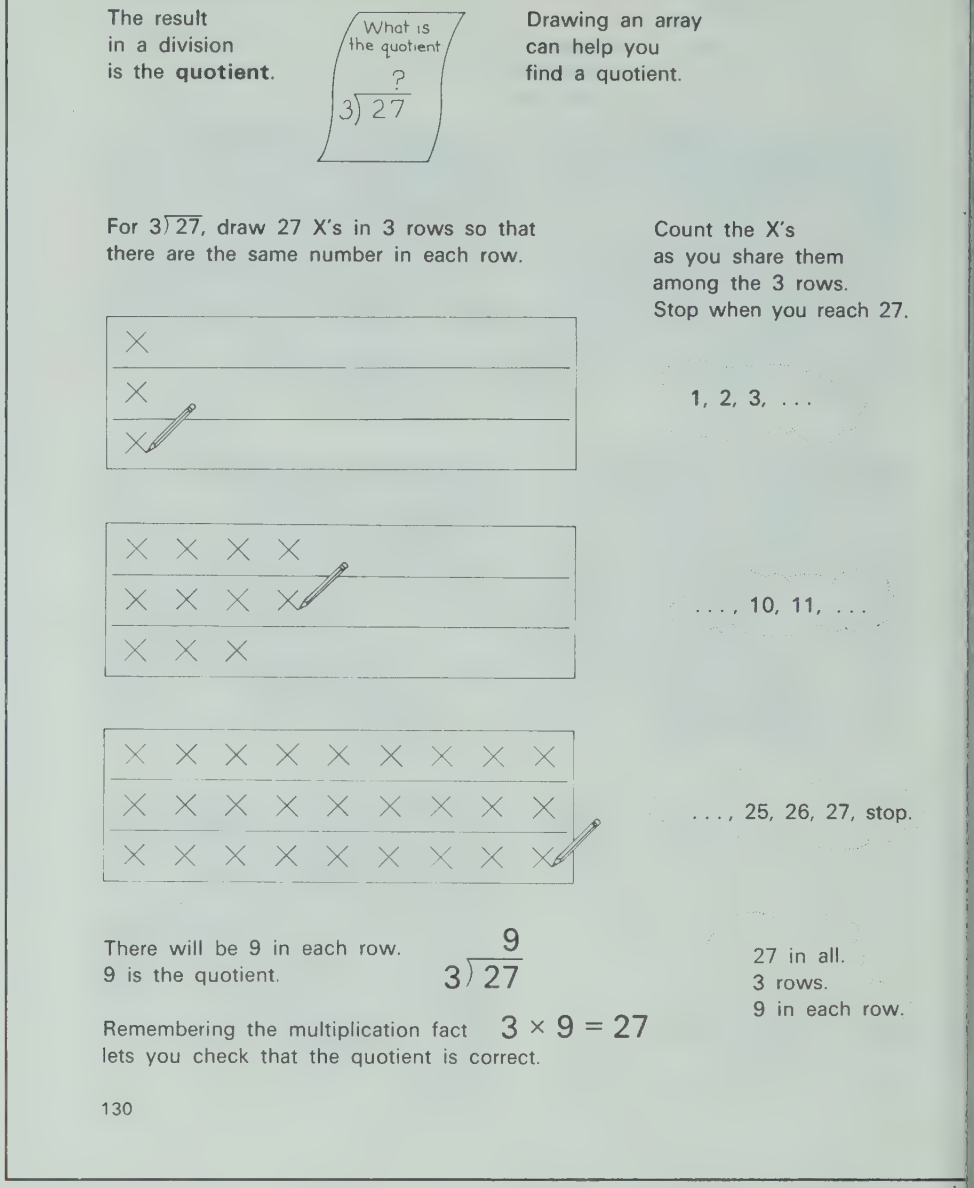
$4\overline{)8}$ $\quad 2$

Draw a picture and write the division fact for each.

2. $5\overline{)20}$ $\quad 4$

3. $3\overline{)12}$ $\quad 4$





Finding the Quotient

The result in a division is the **quotient**.

What is the quotient

$3\overline{)27}$ $\quad ?$

Drawing an array can help you find a quotient.

For $3\overline{)27}$, draw 27 X's in 3 rows so that there are the same number in each row.

Count the X's as you share them among the 3 rows. Stop when you reach 27.

1, 2, 3, . . .

. . . , 10, 11, . . .

. . . , 25, 26, 27, stop.

There will be 9 in each row. 9 is the quotient.

$3\overline{)27}$ $\quad 9$

27 in all.
3 rows.
9 in each row.

Remembering the multiplication fact $3 \times 9 = 27$ lets you check that the quotient is correct.

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LESSON ACTIVITY

Before Using the Pages

- Review the term *array*. Display 12 counters or large objects such as soup cans. Have students arrange them to form a rectangular array having 4 rows. Ask how many objects are in each row. Have students rearrange them to show a rectangular array with 2 rows and repeat the question.

Using the Pages

- The worked example illustrates a method of drawing an array to help find a quotient. The method reinforces the concept of sharing in division as the X's are drawn equally in the rows of the array.

  Point out the term *quotient* at the top of page 130. Lead the students through the example. Have them count the X's in the third illustration to check that there are 27. Ask how the array shows the quotient. Emphasize that it is the number of X's in each row that tells this.

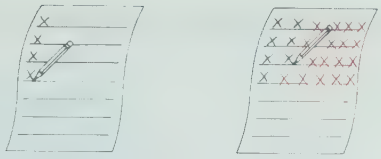
It is important to discuss the use of multiplication checking the division. In this example, the multiplicat fact $3 \times 9 = 27$ confirms that the quotient is 9 for $3\overline{)2}$ which was found by drawing an array of X's.

Working Together: The steps described in Ex. 1-3 develop procedure of sharing X's in equal rows for an array, to f a quotient. Have the students follow similar steps complete Ex. 4-6. You might first ask questions about E 4-6, such as, "How many X's would you draw?" "H many lines would you use?" "What do you count to f the quotient?"

Exercises: Most students will likely realize that it is necessary to count all the X's for matching Ex. 1-3 w diagrams A-C. Since each division has a different divis the number of lines (rows) in each diagram quick identifies the corresponding exercise. For Ex. 4-13, n that a diagram is not required. There are students who w need the support of such diagrams, but others who are a should be encouraged to work without drawing pictur

Working Together

Use a sheet of ruled paper. →



1. Draw 24 X's on 4 lines so that the same number are on each line.
2. Count the number of X's on each line. 6
3. Complete this division fact: $4\overline{)24}^{\,6}$

1, 2, 3, 4, 5, 6, 7, . . .

Draw X's on ruled paper to help you find each quotient.

4. $2\overline{)16}^{\,8}$ 5. $3\overline{)24}^{\,8}$ 6. $5\overline{)20}^{\,4}$

Exercises

Name the picture that matches each division. Use it to help you complete the division fact.

1. $4\overline{)32}^{\,8}$ C
2. $3\overline{)21}^{\,7}$ A
3. $7\overline{)28}^{\,4}$ B

A

B

C

Find each quotient. Use ruled paper and draw a picture if you need to.

4. $2\overline{)8}^{\,4}$ 5. $4\overline{)12}^{\,3}$ 6. $3\overline{)15}^{\,5}$ 7. $5\overline{)30}^{\,6}$ 8. $4\overline{)28}^{\,7}$
9. $7\overline{)21}^{\,3}$ 10. $6\overline{)42}^{\,7}$ 11. $5\overline{)35}^{\,7}$ 12. $9\overline{)27}^{\,3}$ 13. $8\overline{)56}^{\,7}$

14. Write a multiplication fact that matches each division fact in Exercises 1–13.

Sherri put 40 X's in 5 *columns* with the same number in each column. →

. . . , 6, 7, 8, 9, 10, . . .

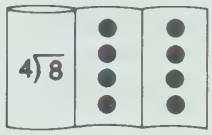
Complete these facts.

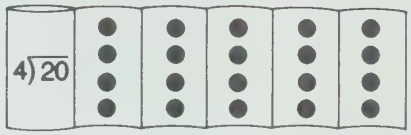
15. $5\overline{)40}^{\,8}$ 16. $5 \times \square = 40$ 8

14. (1) $4 \times 8 = 32$ (2) $3 \times 7 = 21$ (3) $7 \times 4 = 28$ (4) $2 \times 4 = 8$ (5) $4 \times 3 = 12$
(6) $3 \times 5 = 15$ (7) $5 \times 6 = 30$ (8) $4 \times 7 = 28$ (9) $7 \times 3 = 21$
(10) $6 \times 7 = 42$ (11) $5 \times 7 = 35$ (12) $9 \times 3 = 27$ (13) $8 \times 7 = 56$

RELATED ACTIVITIES

• The second activity in *Related Activities* on page T 105 describes a device that is useful for basic multiplication facts. A similar device may be prepared for use with division. For division by 4, for example, the strip is marked as shown below. For any length of strip displayed, the quotient may be found by counting the columns in the array. Students may use the strips as needed when working with division facts.





Note also that from now on emphasis is given to showing division facts using the symbol $\overline{)}$, since this is the form used in the algorithm. Ensure that the students read the instructions carefully prior to Ex. 15. The X's are to be shared in columns rather than in rows.

ssessment

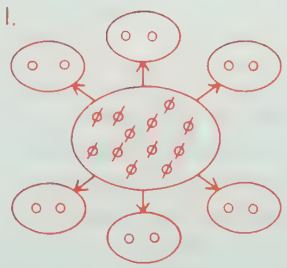
nd each quotient. Draw a picture to help you.

$6\overline{)12}^{\,2}$ 2. $5\overline{)15}^{\,3}$ 3. $7\overline{)28}^{\,4}$

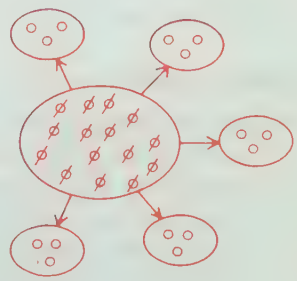
Write a multiplication fact that matches each division fact in Ex. 1-3.

(1) $6 \times 2 = 12$ (2) $5 \times 3 = 15$ (3) $7 \times 4 = 28$

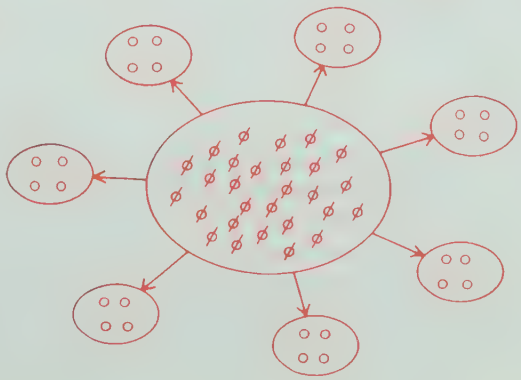
1.



2.



3.



Pages 132-133

LESSON OUTCOME

Write the family of multiplication and division facts for three given numbers, using arrays

Materials

12 counters for each student

Prerequisite Skills

Write a multiplication fact that matches a division fact

Checking Prerequisite Skills

Find each quotient. Then write a multiplication fact that matches each division fact.

1. $2\overline{)6}$ (3) $2 \times 3 = 6$ **2.** $5\overline{)10}$ (2) $5 \times 2 = 10$ **3.** $8\overline{)16}$ (2) $8 \times 2 = 16$

Related Multiplication and Division Facts

Gerry had 28 stamps. She made this array.

28 stamps in 7 rows

$$7\overline{)28}\ 4$$

4 in each row

$7 \times 4 = 28$

28 stamps in 4 columns

$$4\overline{)28}\ 7$$

7 in each column

$4 \times 7 = 28$

The numbers 28, 4, and 7 give a family of four multiplication and division facts.

$7\overline{)28}\ 4$	$4\overline{)28}\ 7$
$7 \times 4 = 28$	$4 \times 7 = 28$

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LESSON ACTIVITY

Before Using the Pages

- Have each student use 12 counters and arrange them in four equal rows. Ask how many are in each row. Then have them arrange the 12 counters in three equal rows and ask how many are in each row. Develop that the counters need not be moved at all for the second case if the original arrangement is looked at from a different point of view. Restate the second case as an arrangement of 12 counters in 3 equal columns.

Using the Pages

- The example illustrates that a rectangular array can be considered from the following two points of view.
  1. How many rows are there?
     How many items are in each row?
  2. How many columns are there?
     How many items are in each column?

  Since each point of view gives rise to one division fact and a related multiplication fact, the array can be used to derive a *family* of four multiplication and division facts.

  Begin with a brief discussion of the photograph. Encourage students to tell about their own stamp collections. Point out that the stamps in the photograph form a rectangular array. Develop that there are 28 stamps in all and consider them from the two points of view:
  1. the number of rows and the number of stamps in each row;
  2. the number of columns and the number of stamps in each column.

  Suggest that an array is useful because it helps us to think of multiplication and division facts in families. Draw the students' attention to the family of four facts at the bottom of page 132. Some students may recall earlier work in which addition and subtraction facts were considered in families.

Working Together: Ex. 1 and 2 show arrays to help students write the families of facts. For Ex. 3-5, one fact is provided to help them complete the remaining facts. Finally, the

RELATED ACTIVITIES

• In the *Related Activities* on page T 103 in Unit 5, it was suggested that students help to prepare a display of arrays. If this was done, students may choose pictures of arrays and write a family of multiplication and division facts for each array.

Working Together

Give two multiplication facts and two division facts to match each array.

1. $2 \times 7 = 14$, $7 \times 2 = 14$

2 rows, 7 columns, 14 in all.

$2\overline{)14}^{\,7}$, $7\overline{)14}^{\,2}$

2. $6 \times 5 = 30$, $5 \times 6 = 30$

$6\overline{)30}^{\,5}$, $5\overline{)30}^{\,6}$

Use the one complete fact to help you complete the other facts in each family.

3. $4 \times 7 = 28$; $7 \times \square = 28$ 4; $28 \div 7 = \square$ 4; $28 \div 4 = \square$ 7

4. $9\overline{)54}^{\,6}$ $9 \times 6 = 54$; $6\overline{)54}^{\,9}$ $6 \times \square^{\,9} = 54$

5. $6 \times 2 = 12$; $6\overline{)12}^{\,2}$; $2\overline{)12}^{\,6}$; 12; $\square \times \square = \square$; 2 6 12

Write the family of division facts and multiplication facts for each group of numbers.

6. 18, 3, and 6 — $3 \times 6 = 18$, $6 \times 3 = 18$, $3\overline{)18}^{\,6}$, $6\overline{)18}^{\,3}$

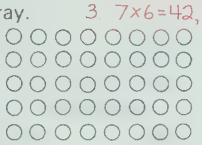
7. 1, 8, and 8 — $1 \times 8 = 8$, $8 \times 1 = 8$, $1\overline{)8}^{\,8}$, $8\overline{)8}^{\,1}$

8. 5, 5, and 25 — $5 \times 5 = 25$, $5\overline{)25}^{\,5}$

Exercises

Write two multiplication facts and two division facts to match each array.

1.

2. 

3.

Write the complete family of facts for each group of numbers.

4. $5 \times 3 = 15$; $3 \times \square = 15$; $15 \div 3 = \square$ 5; $15 \div 5 = \square$ 3

5. $8\overline{)48}^{\,6}$ $6\overline{)48}^{\,8}$; $6 \times \square^{\,8} = 48$; $8 \times \square^{\,6} = 48$

6. $9\overline{)27}^{\,3}$ $9 \times 3 = 27$; $3 \times 9 = 27$ $3\overline{)27}^{\,9}$

7. 8, 4, 32
8. 5, 10, 2
9. 6, 2, 3
10. 7, 7, 49
11. 9, 4, 36
12. 21, 3, 7
13. 5, 1, 5
14. 9, 72, 8
15. 64, 8, 8

Answers for Ex 7-15 are given below.

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students are required to write the family of facts for three given numbers. For Ex. 1-8, then, the development proceeds from the semi-abstract to the abstract. It may be necessary for some students to draw arrays for assistance. Note that Ex. 8 provides an opportunity to discuss that some families are smaller than others. Have students suggest what is true about the number of rows and the number of columns (factors) if the family is made up of just two facts. Discuss that the array is square for such families.

Exercises: Note that the two symbols ÷ and $\overline{)}$ are encountered. You may wish to suggest that the students use the symbol ÷ for division facts in Ex. 7-9 and the symbol $\overline{)}$ for division facts in the remaining exercises.

Assessment

Write the complete family of facts for each group of numbers.

1. 7, 5, 35 — $7 \times 5 = 35$, $5 \times 7 = 35$, $35 \div 7 = 5$, $35 \div 5 = 7$

2. 4, 16, 4 — $4 \times 4 = 16$, $16 \div 4 = 4$

Exercises

7. $8 \times 4 = 32$, $4 \times 8 = 32$, $8\overline{)32}^{\,4}$, $4\overline{)32}^{\,8}$
8. $2 \times 5 = 10$, $5 \times 2 = 10$, $2\overline{)10}^{\,5}$, $5\overline{)10}^{\,2}$
9. $2 \times 3 = 6$, $3 \times 2 = 6$, $2\overline{)6}^{\,3}$, $3\overline{)6}^{\,2}$
10. $7 \times 7 = 49$, $7\overline{)49}^{\,7}$
11. $9 \times 4 = 36$, $4 \times 9 = 36$, $9\overline{)36}^{\,4}$, $4\overline{)36}^{\,9}$
12. $3 \times 7 = 21$, $7 \times 3 = 21$, $3\overline{)21}^{\,7}$, $7\overline{)21}^{\,3}$
13. $5 \times 1 = 5$, $1 \times 5 = 5$, $5\overline{)5}^{\,1}$, $1\overline{)5}^{\,5}$
14. $9 \times 8 = 72$, $8 \times 9 = 72$, $9\overline{)72}^{\,8}$, $8\overline{)72}^{\,9}$
15. $8 \times 8 = 64$, $8\overline{)64}^{\,8}$

Pages 134-135

OBJECTIVE

Use the multiplication table to help complete division facts

Vocabulary

basic division facts

Practice

An array can help us find a product for any two factors.

For 6×7, an array with 6 rows and 7 columns will have 42 in all.

$$6 \times 7 = 42$$

Count the red blocks to check that 42 is correct.

×	1	2	3	4	5	6	7	8	9
1									
2									
3									
4									
5									
6									
7									
8									
9									

The 81 products in this multiplication table form an array.

In an array like the one shown in red, the number in the lower right corner shows how many are in the array.

$$6 \times 7 = 42$$

×	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9
2	2	4	6	8	10	12	14	16	18
3	3	6	9	12	15	18	21	24	27
4	4	8	12	16	20	24	28	32	36
5	5	10	15	20	25	30	35	40	45
6	6	12	18	24	30	36	42	48	54
7	7	14	21	28	35	42	49	56	63
8	8	16	24	32	40	48	56	64	72
9	9	18	27	36	45	54	63	72	81

This multiplication table can help you with the basic division facts.

For $42 \div 6$, look across the row for the factor 6 and find the column with 42 in it. Look to the top of this column and find the other factor, 7.

$$6\overline{)42}\quad 7$$

×	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9
2	2	4	6	8	10	12	14	16	18
3	3	6	9	12	15	18	21	24	27
4	4	8	12	16	20	24	28	32	36
5	5	10	15	20	25	30	35	40	45
6	6	12	18	24	30	36	42	48	54
7	7	14	21	28	35	42	49	56	63
8	8	16	24	32	40	48	56	64	72
9	9	18	27	36	45	54	63	72	81

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LESSON ACTIVITY

Using the Pages

- The multiplication table was met in the previous unit in summarizing the basic multiplication facts. At this time, the table is also seen as a nine-by-nine array. Students can associate the fact $6 \times 7 = 42$ with an array of 6 rows and 7 columns in the table, and the product 42 is shown in the lower right corner of the array. The use of color on the table helps to show the array.

  Lead the students through the example, having them count the blocks as suggested for the first (red) array. Have them study this array shown in red in the multiplication table beneath. Emphasize that here there is not only a six-by-seven array, but also the product of 6 and 7 as shown in the lower right corner of the array. Discuss the third diagram and develop how the multiplication table is useful for finding quotients. Note that the numerals in the table appear in positions similar to those in the division exercise.

×	7
6	42

$$6\overline{)42}\quad 7$$

Have the students use the tables on page 134 demonstrate other products and quotients. Ask, f example, for 4×8,

"How many rows are there?"

"How many columns are there?"

"Where is the product shown in the array?"

For $28 \div 7$, ask,

"Which row would you search?"

"What number would you search for in the row?"

"Where is the quotient found?"

Exercises: Note that it is suggested that students use th multiplication table for Ex. 1-36 only if they need t Encourage them to complete as many as they can witho using the table.

Ex. 37-43 emphasize that the quotient in division name the missing factor in a corresponding multiplication. Whe the students have completed these, it would help t

Exercises

Divide. Use the multiplication table if you need to.

1. $4\overline{)20}$	5	**2.** $3\overline{)15}$	5	**3.** $7\overline{)28}$	4
4. $9\overline{)81}$	9	**5.** $8\overline{)40}$	5	**6.** $5\overline{)25}$	5
7. $2\overline{)16}$	8	**8.** $6\overline{)18}$	3	**9.** $4\overline{)12}$	3
10. $45 \div 9$	5	**11.** $14 \div 7$	2	**12.** $56 \div 8$	7
13. $7\overline{)49}$	7	**14.** $9\overline{)72}$	8	**15.** $3\overline{)21}$	7
16. $5\overline{)30}$	6	**17.** $4\overline{)16}$	4	**18.** $2\overline{)12}$	6
19. $1\overline{)6}$	6	**20.** $8\overline{)24}$	3	**21.** $8\overline{)32}$	4
22. $32 \div 4$	8	**23.** $48 \div 6$	8	**24.** $64 \div 8$	8
25. $3\overline{)27}$	9	**26.** $4\overline{)4}$	1	**27.** $9\overline{)54}$	6
28. $7\overline{)35}$	5	**29.** $5\overline{)45}$	9	**30.** $4\overline{)24}$	6
31. $9\overline{)18}$	2	**32.** $7\overline{)63}$	9	**33.** $7\overline{)56}$	8
34. $48 \div 8$	6	**35.** $35 \div 5$	7	**36.** $9 \div 3$	3

Divide to find another factor.

Example: 6 is one factor of 42.

$6\overline{)42}$ → 7 (because $6 \times 7 = 42$)

7 is another factor of 42.

	Product	One factor	
37.	10	2	5
38.	24	6	4
39.	18	3	6
40.	63	9	7
41.	20	5	4
42.	72	8	9
43.	24	3	8

Joanne has collected 8 different hockey cards.

Study the information in this chart.

Position	Players needed	Joanne has cards for
Forward	2	2
Defense	2	2
Center	1	3
Goalie	1	1

1. How many different lineups can Joanne put on the ice with her 8 cards? 3
2. Joanne trades 1 center for a new forward. Now how many different lineups can Joanne put on the ice? 6

PROBLEM SOLVING

familiarize them with the language of factors and products if they read their answers aloud in the following manner.

Ex. 37. The product is 10.
One factor is 2.
The other factor is 5.

roblem Solving: Students who have collected hockey cards at any time will find this problem appealing. The chart shows the number of players needed for each position of a team. Since Joanne has 3 cards for one center position, she can put 3 different lineups on the ice. Students may need to experiment with cards to find the answer for Ex. 2. Some may realize that the number of lineups is found from $3 \times 2 = 6$.

RELATED ACTIVITIES

• Have students play a game in small groups, referring to copies of page T350 as needed. One player says, "I am thinking of a product. The factors are two and six." The first player to name the product begins the next round. Different clues may be used as suggested below.

1. The product is 16.
   One factor is 2.
   What is the other factor?
2. The product is 36.
   The two factors are equal.
   What are the factors?

Pages 136-137

LESSON OUTCOME

Use multiplication to divide; solve related word problems

Prerequisite Skills

Write the family of multiplication and division facts for three given numbers

Checking Prerequisite Skills

Write the complete family of facts for each group of numbers.

1. 4, 6, 24 **2.** 56, 7, 8

3. 3, 9, 3 **4.** 9, 45, 5

1. $4 \times 6 = 24$, $6 \times 4 = 24$, $24 \div 4 = 6$, $24 \div 6 = 4$

2. $7 \times 8 = 56$, $8 \times 7 = 56$, $56 \div 7 = 8$, $56 \div 7 = 8$

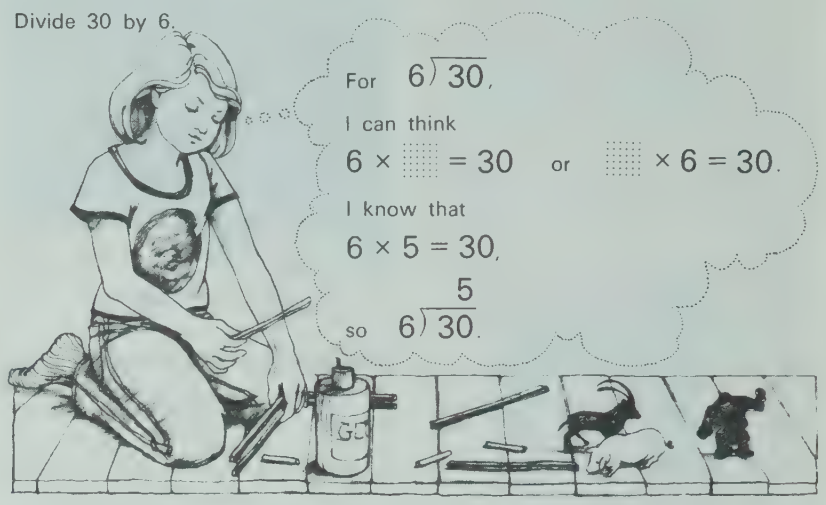
3. $3 \times 3 = 9$, $9 \div 3 = 3$

4. $9 \times 5 = 45$, $5 \times 9 = 45$, $45 \div 9 = 5$, $45 \div 5 = 9$

Using Multiplication to Divide

Today, Jean will have 6 pens for her 30 animals. How many will she put in each pen so that each pen has the same number of animals?

Divide 30 by 6.



Jean will put 5 animals in each pen.

Working Together

Complete.

1. $4 \times \overset{8}{\square} = 32$ **2.** $8 \times \overset{7}{\square} = 56$

$4\overline{)32}^{\,8}$ $8\overline{)56}^{\,7}$

Give a multiplication fact that can be used for each division. Then complete the division fact.

3. $5\overline{)15}^{\,3}$ $5 \times 3 = 15$

4. $9\overline{)54}^{\,6}$ $9 \times 6 = 54$

Divide.

5. $3\overline{)21}^{\,7}$

6. $8\overline{)48}^{\,6}$

Exercises

Divide. Show the multiplication fact you use.

$3 \times 4 = 12$, 4	$2 \times 7 = 14$, 7	$5 \times 9 = 45$, 9
1. $3\overline{)12}$	**2.** $2\overline{)14}$	**3.** $5\overline{)45}$
$4 \times 4 = 16$, 4	$6 \times 6 = 36$, 6	$9 \times 2 = 18$, 2
4. $4\overline{)16}$	**5.** $6\overline{)36}$	**6.** $9\overline{)18}$
$5 \times 7 = 35$, 7	$8 \times 9 = 72$, 9	$3 \times 8 = 24$, 8
7. $5\overline{)35}$	**8.** $8\overline{)72}$	**9.** $3\overline{)24}$
$7 \times 8 = 56$, 8	$9 \times 8 = 72$, 8	$6 \times 3 = 18$, 3
10. $7\overline{)56}$	**11.** $9\overline{)72}$	**12.** $6\overline{)18}$
$9 \times 5 = 45$, 5	$7 \times 9 = 63$, 9	$6 \times 4 = 24$, 4
13. $9\overline{)45}$	**14.** $7\overline{)63}$	**15.** $6\overline{)24}$
$7 \times 6 = 42$, 6	$4 \times 9 = 36$, 9	$8 \times 8 = 64$, 8
16. $7\overline{)42}$	**17.** $4\overline{)36}$	**18.** $8\overline{)64}$

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LESSON ACTIVITY

Using the Pages

- The emphasis now is given to using multiplication as an efficient way of finding a quotient. The worked example presents students with a division situation and shows Jean's way of thinking of multiplication. Have the students study the example. Discuss that the problem involves division since finding the number in each of six equal groups is required. Point out that only one multiplication, either $6 \times \square = 30$ or $\square \times 6 = 30$, is necessary, depending on which order helps to recall the missing factor, 5.

Working Together: Ex. 1 and 2 provide a related multiplication fact to help with the division. This establishes a procedure that may be applied in Ex. 3 and 4. For Ex. 5 and 6, the helpful multiplication fact need not be written, but it is advisable to consider that aspect orally when discussing the exercises.

Exercises: Ex. 1-18 require the students to show the relate multiplication fact that helps with the division. Th procedure helps students to commit facts to memory a facilitates the procedure used in the division algorithm.

If necessary, help students with the word problems. E 24 is starred since its solution involves more than one ste and another operation besides division. It would be helpf to have students orally list in order the different steps th lead to the solution.

Assessment

Divide. Show the multiplication fact you use.

1. $7\overline{)35}^{\,5}$ $7 \times 5 = 35$

2. $6\overline{)24}^{\,4}$ $6 \times 4 = 24$

3. $9\overline{)81}^{\,9}$ $9 \times 9 = 81$

4. $8\overline{)8}^{\,1}$ $8 \times 1 = 8$

Solve. Show the division.

5. Jean has 24 animals and 8 pens. How many animals can she keep in each pen so that each pen has the same number of animals? 3

Solve. Show each division.

19. Last month, Jean had 4 pens and 24 animals. How many did she keep in each pen so that each pen had the same number?

$4\overline{)24}$, 6

20. Last week, Jean had 5 pens and 25 animals. How many did she keep in each pen so that each pen had the same number?

$5\overline{)25}$, 5

21. Jean also has a collection of 28 dolls from 4 countries. She has the same number of dolls from each country. How many has she from each country?

$4\overline{)28}$, 7

22. Jean has 21 items of clothing for her 7 dolls from Mexico. If she puts the same number of items on each doll, how many items are on each doll?

$7\overline{)21}$, 3

23. For her birthday Jean got a book that had 27 outfits for 3 paper dolls. There were the same number of outfits for each doll. How many outfits were there for each doll?

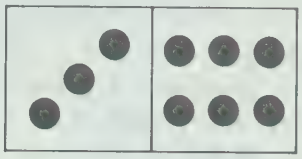
$3\overline{)27}$, 9

***24.** Jean had 30 animals and 6 pens. She was given 2 more animals. She built 2 more pens. Now how many animals can she keep in each pen so that each pen has the same number of animals?

$8\overline{)32}$, 4

RELATED ACTIVITIES

• Have each student draw one domino from a pile of dominoes and write a family of multiplication and division facts for the numbers represented. First remove all those dominoes that would represent the number zero.



$3 \times 6 = 18$ $\quad$ $18 \div 3 = 6$

$6 \times 3 = 18$ $\quad$ $18 \div 6 = 3$

Pages 138-139

LESSON OUTCOME

Associate division with finding the number of equal groups (quotitive or measurement division); use division to find the number of equal groups

Materials

counters or elevator beads (see page T344) for each student

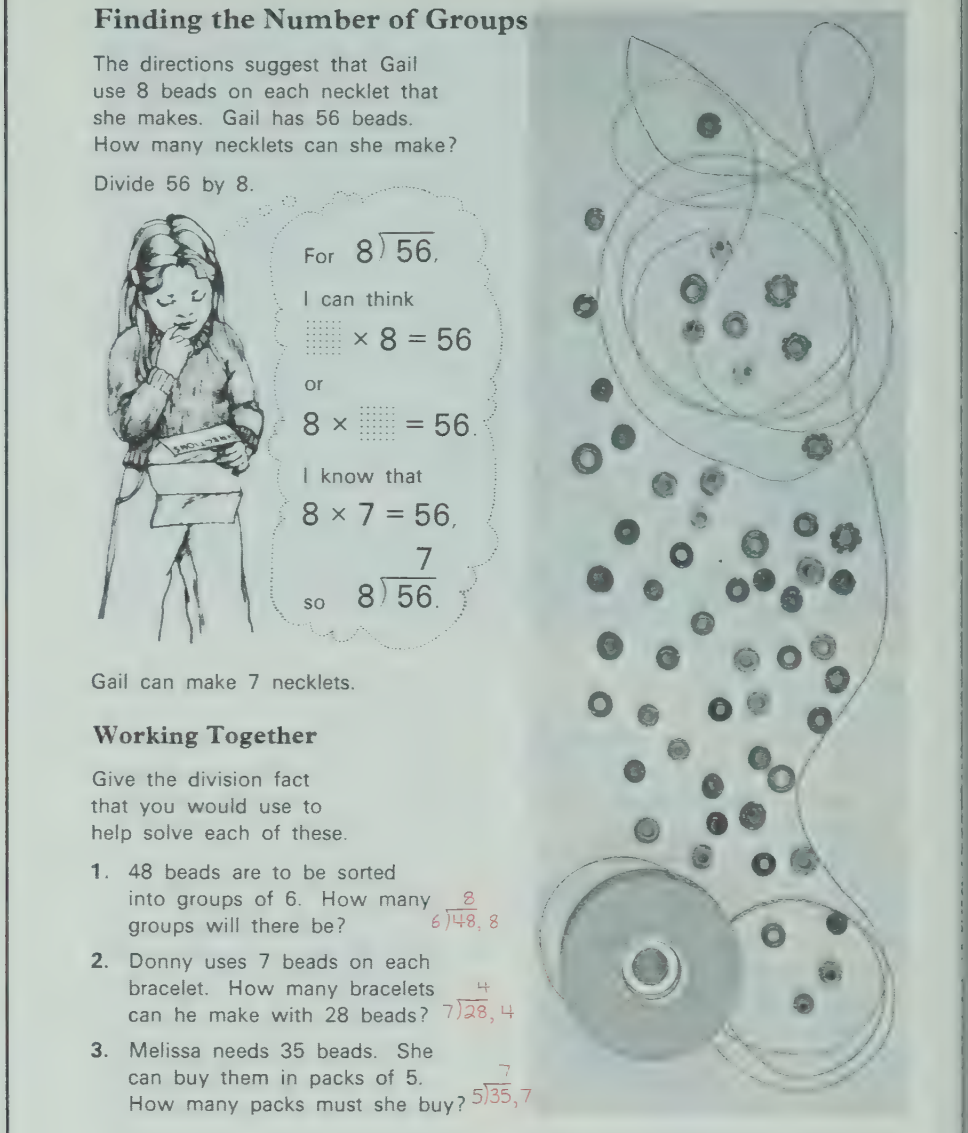
Prerequisite Skills

Complete basic division facts

Checking Prerequisite Skills

Divide. Show the multiplication fact you use. $4 \times 9 = 36$ $2 \times 6 = 12$

1. $4\overline{)36}$ $\quad 9$
2. $2\overline{)12}$ $\quad 6$
3. $1\overline{)9}$ $\quad 9$, $1 \times 9 = 9$
4. $7\overline{)49}$ $\quad 7$, $7 \times 7 = 49$



Finding the Number of Groups

The directions suggest that Gail use 8 beads on each necklet that she makes. Gail has 56 beads. How many necklets can she make?

Divide 56 by 8.

For $8\overline{)56}$,

I can think

$\square \times 8 = 56$

or

$8 \times \square = 56$.

I know that

$8 \times 7 = 56$,

so 7, $8\overline{)56}$.

Gail can make 7 necklets.

Working Together

Give the division fact that you would use to help solve each of these.

1. 48 beads are to be sorted into groups of 6. How many groups will there be? 8, $6\overline{)48}$, 8
2. Donny uses 7 beads on each bracelet. How many bracelets can he make with 28 beads? 4, $7\overline{)28}$, 4
3. Melissa needs 35 beads. She can buy them in packs of 5. How many packs must she buy? 7, $5\overline{)35}$, 7

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LESSON ACTIVITY

Before Using the Pages

- Review the concept of forming equal groups. Have each student arrange 12 counters into groups of two. Ask how many groups there are. Have them take 16 counters and form groups of eight. Ask how many eights there are in sixteen. Ask what could be done to find how many threes there are in fifteen. Ask if the answer can be found without using counters.

Using the Pages

- The example suggests that if the number in each group is known, finding the number of groups can be expressed by a division fact. Gail knows the number of beads on each necklet is to be 8, and, thus, $8\overline{)56}$ shows that she can make 7 necklets.

  Begin with a discussion of the illustration. Develop that finding the number of groups is related to division. Point out that Gail thought of a multiplication fact to help find the quotient in the division.

Working Together: These exercises concentrate on the use division to find the number of groups. It may be necess for some students to check their answers by using count For example, in Ex. 1, a student may write the division $6\overline{)48}$, but he/she may need to check with counters that implies 8 groups of 6. Use other similar exercises needed.

Exercises: Ex. 1-4 reinforce the measurement aspect division. Ex. 5-19 return to abstract division, us multiplication to find the quotients. Ex. 20 is star because it involves more than one step. Also, since earrings form one pair, the number of pairs she can mak three. Thus, the second division involves the concept remainder. For Ex. 21, also starred, there is more than answer. Lyn may choose to make 7 bracelets with 5 be on each and 1 bracelet with 6 beads, or 6 bracelets wit beads on each and 1 bracelet with 5 beads.

Exercises

Solve. Show each division.

1. Louis needs 36 beads. He can buy them in packs of 6. How many packs must he buy?
2. Louis will make necklets that use 9 beads each. How many can he make with 36 beads?
3. A belt needs 24 beads tied in groups of 3. How many groups of beads will be in the belt?
4. 4 beads are used in a ring pattern. How many rings could be made using this pattern if there are 24 beads?

Divide. Show the multiplication fact you use.

5. $6\overline{)12}$	6. $5\overline{)20}$	7. $4\overline{)28}$
8. $3\overline{)18}$	9. $2\overline{)18}$	10. $8\overline{)64}$
11. $7\overline{)21}$	12. $9\overline{)54}$	13. $5\overline{)25}$
14. $9\overline{)81}$	15. $4\overline{)20}$	16. $7\overline{)35}$
17. $4\overline{)36}$	18. $8\overline{)24}$	19. $9\overline{)45}$

Solve.

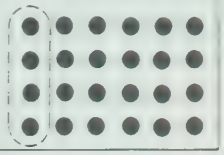
*20. Tammy has 21 beads. She needs 3 for each earring. How many pairs of earrings can she make?

*21. Lyn can use 5 or 6 beads on each bracelet. She has 41 beads. How many bracelets can she make so that she uses all the beads? How many beads will be on each bracelet?

RELATED ACTIVITIES

- Students who need practice in finding the number of groups may draw dot pictures and ring groups of dots as in the following example.

Draw 24 dots.
Ring groups of 4 dots.
How many 4's in 24?
$4\overline{)24}$



- Have students write problems, similar to Ex. 1-4 on page 139, for other students to solve. If beads or suitable pasta pieces are available, have students who are interested take a specified number of beads and thread the same number on each string to show how many strings would be used. These examples may be displayed with the problem cards prepared earlier.
- Have students complete exercises, similar to the following, to illustrate how the quotient or the product changes as one of the factors changes.

1. $12 \div 2 =$ ▒
   $12 \div 3 =$ ▒
   $12 \div 4 =$ ▒
   $12 \div 6 =$ ▒

2. $3 \times$ ▒ $= 24$
   $4 \times$ ▒ $= 24$
   $6 \times$ ▒ $= 24$
   $8 \times$ ▒ $= 24$

3. $8 \div 8 =$ ▒
   $8 \div 4 =$ ▒
   $8 \div 2 =$ ▒
   $8 \div 1 =$ ▒

4. ▒ $\times 6 = 6$
   ▒ $\times 3 = 6$
   ▒ $\times 2 = 6$
   ▒ $\times 1 = 6$

sessment

ve. Show each division.

45 beads. 9 for each necklet. How many necklets? 5

$9\overline{)45}$

2. 7 beads for each ring. How many rings can be made from 28 beads? 4

$7\overline{)28}$

ide. Show the multiplication fact you use.

3. $3\overline{)24}$ 8
   $\times 8 = 24$
4. $9\overline{)18}$ 2
   $9 \times 2 = 18$
5. $6\overline{)36}$ 6
   $6 \times 6 = 36$

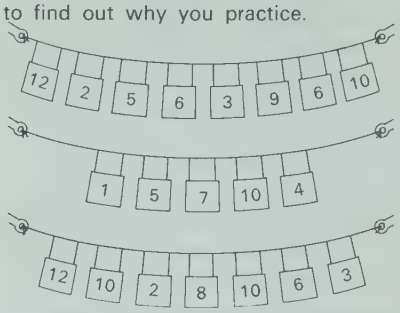
Pages 140-141

OBJECTIVE

Demonstrate competence in division; solve related word problems

Practice

Decode the message to find out why you practice.



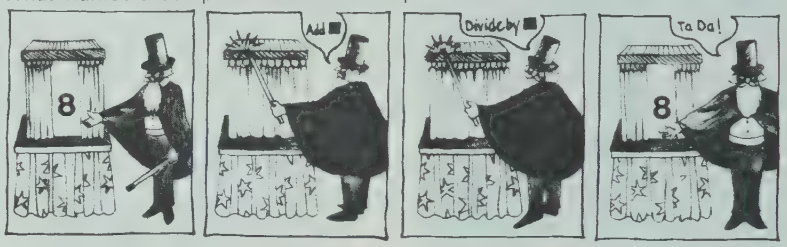
A $8\overline{)40}$ 5	C $4\overline{)24}$ 6	D 7×2 14
E 2×5 10	F $7\overline{)56}$ 8	I $5\overline{)45}$ 9
K $6\overline{)42}$ 7	M $3\overline{)3}$ 1	P 4×3 12
R $4\overline{)8}$ 2	S $9\overline{)36}$ 4	T $8\overline{)24}$ 3

PRACTICE MAKES PERFECT

The students showed their collections at the hobby show.

1. Phillip displayed 21 badges on 7 cards. The cards each had the same number of badges. Write the division fact that shows how many badges were on each card. $7\overline{)21}$, 3
2. Helen set up 56 pieces of doll furniture in groups of 8. How many groups of furniture did Helen display? 7
3. Harvey made cardboard hands to show his finger puppets. He put 5 puppets on each hand. How many hands did he need for 30 finger puppets? 6
4. Leah showed 48 rings in 6 boxes. The boxes each had the same number of rings. How many rings were in each box? 8
5. The school set up 9 tables for 54 displays. All the tables had the same number of displays. How many displays were on each table? 6

What numbers complete this comic strip?



PROBLEM SOLVING

Answers will vary. Possible answers are 0, 1; 8, 2; 16, 3; 24, 4; 32, 5; and so on

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LESSON ACTIVITY

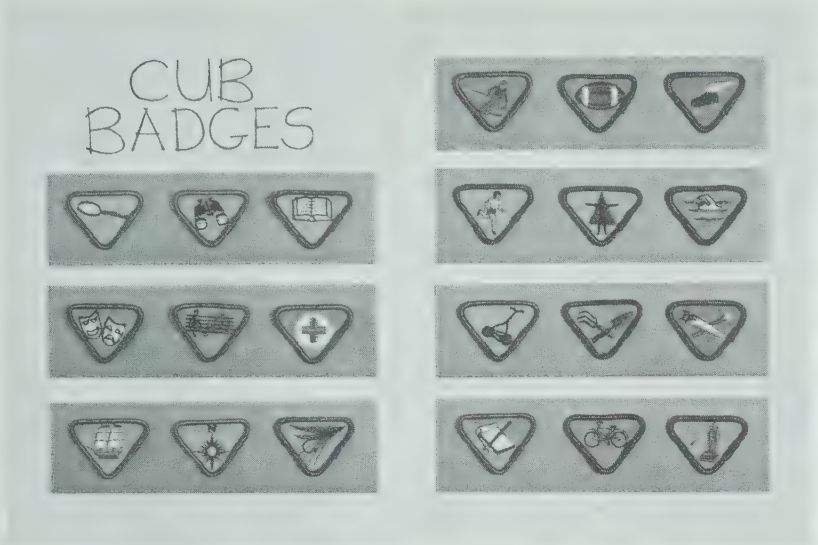
Using the Pages

- Ex. 1-9 provide practice in the two interpretations of division, sharing and measurement. Note that the page begins with a secret message that the students are to decode. It will tell why one should practice.

  Some students may be able to compute the divisions mentally for Ex. 10-19 and write the appropriate division facts to answer the question. Note that for Ex. 12, neither quotient is the greater because they are equal. The quotients in Ex. 16 are also equal.

Problem Solving: If students find one solution to this problem, ask them to try to find another solution. There are many solutions, based on the fact that the division step can undo the effect of the addition.

$8 + 0 = 8$, $8 \div 1 = 8$;
$8 + 8 = 16$, $16 \div 2 = 8$;
$8 + 16 = 24$, $24 \div 3 = 8$;
and so on.



6. Gerry had 72 stamps. She put them into packets with 8 in each packet. How many packets of stamps did she have? 9

7. Jean displayed 32 toy animals on 4 shelves. She put the same number on each shelf. How many did she put on each shelf? 8

8. Geoffrey's display had room for 5 trays that showed some of his rock collection. He wanted to show 45 rocks with the same number on each tray. How many rocks did he put on each tray? 9

9. Laurie had 81 bottle caps set up in an array with 9 rows. How many caps were in each row? 9

Which gives the greater quotient,

10. $3\overline{)12}$ or $4\overline{)12}$? $3\overline{)12}$

11. $6\overline{)24}$ or $6\overline{)42}$? $6\overline{)42}$

12. $9\overline{)27}$ or $8\overline{)24}$? same

Which gives the greatest quotient,

13. $5\overline{)25}$, $5\overline{)30}$, or $5\overline{)40}$? $5\overline{)40}$

14. $4\overline{)36}$, $6\overline{)36}$, or $9\overline{)36}$? $4\overline{)36}$

15. $2\overline{)12}$, $4\overline{)28}$, or $8\overline{)48}$? $4\overline{)28}$

16. $1\overline{)4}$, $3\overline{)12}$, $6\overline{)24}$, or $9\overline{)36}$? same

17. $3\overline{)24}$, $7\overline{)42}$, $8\overline{)72}$, or $9\overline{)27}$? $8\overline{)72}$

18. $8\overline{)40}$, $6\overline{)42}$, $5\overline{)45}$, or $7\overline{)49}$? $5\overline{)45}$

19. $3\overline{)27}$, $4\overline{)32}$, $5\overline{)35}$, or $6\overline{)36}$? $3\overline{)27}$

RELATED ACTIVITIES

- The students may enjoy exercises they are to complete silently as you read the steps; for example, "Seven. . .plus five. . .divided by two. . .minus four. . .times nine."
- Other problems similar to the one in the *Problem Solving* feature may be written by the students. For example, have them replace the number 8 in the magician's act by the number 5 and solve the new problem.

Pages 142-143

LESSON OUTCOME

Divide a multiple of ten by a one-digit number, quotients to 90 (remainder zero)

Materials

models for tens and hundreds

Prerequisite Skills

Complete basic division facts; multiply a multiple of ten by a one-digit number

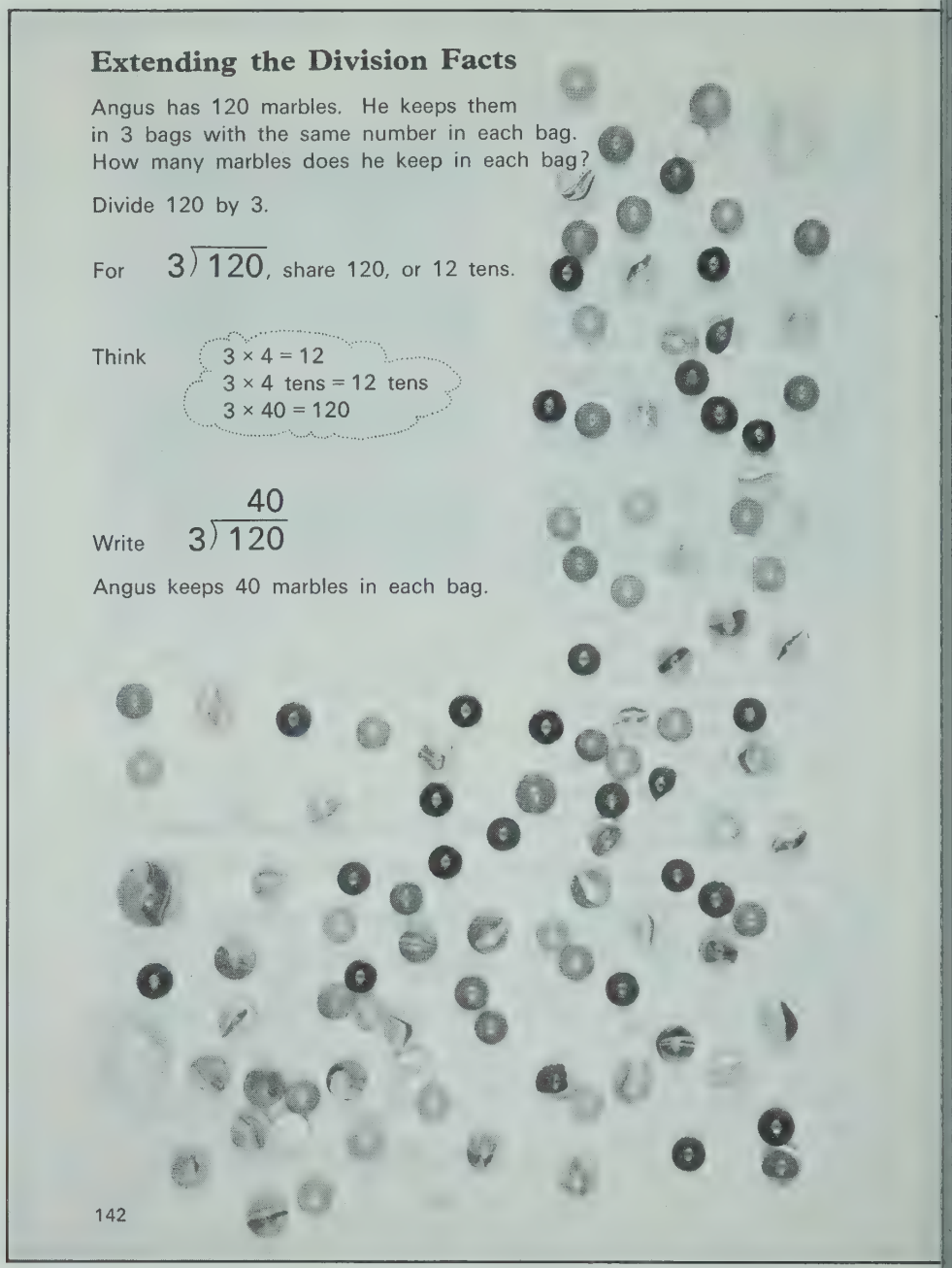
Checking Prerequisite Skills

Divide.

1. $4\overline{)20}$ $\quad 5$
2. $8\overline{)56}$ $\quad 7$
3. $9\overline{)45}$ $\quad 5$
4. $3\overline{)27}$ $\quad 9$

Multiply.

5. $40 \times 3 = 120$
6. $20 \times 7 = 140$
7. $80 \times 5 = 400$
8. $30 \times 9 = 270$



Extending the Division Facts

Angus has 120 marbles. He keeps them in 3 bags with the same number in each bag. How many marbles does he keep in each bag?

Divide 120 by 3.

For $3\overline{)120}$, share 120, or 12 tens.

Think
$3 \times 4 = 12$
3×4 tens $= 12$ tens
$3 \times 40 = 120$

Write $3\overline{)120}$ $\quad 40$

Angus keeps 40 marbles in each bag.

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LESSON ACTIVITY

Before Using the Pages

- Display models for 6 tens. Ask what number is represented. Have three students share the tens equally and tell how many tens there are for each. Ask what number 2 tens represents. Repeat the procedure for other similar examples. Then display 1 hundred and 5 tens. Ask what number is shown. Ask if this way of representing 150 makes it convenient for 3 persons to share the models. Lead the students to suggest regrouping the 1 hundred as 10 tens to show 15 tens in all. Complete the sharing procedure as in the earlier examples.

Using the Pages

- To divide a multiple of ten by a one-digit number, students are encouraged to think of the dividend in terms of tens, and then to relate this to a basic multiplication fact. Thus, in the worked example,

  $3\overline{)120}$ is thought of as $3\overline{)12 \text{ tens}}$.

  Then, the basic multiplication fact $3 \times 4 = 12$ and extension $3 \times 40 = 120$ may be applied.

  Begin with a brief discussion of the illustration. Perha some of the students in your class have marble collectio Discuss that it is inefficient to share the 120 marbles one one in the three bags and that it is easier to think o multiplication fact to solve the division $3\overline{)120}$. Point that thinking of 120 as 12 tens suggests the f $3 \times 4 = 12$, and then 3×4 tens $= 12$ tens,

  $3 \times 40 = 120$, which relate to $120 \div 3 = 40$, or $3\overline{)12}$

Working Together: For Ex. 1 and 2, the steps are shown f thinking of a basic multiplication fact and its extension fo multiple of ten, to help find the quotient. Some stude may need other similar exercises to help them develop t thought process. This process is applied in working Ex. 3 and, for these, one of three possible facts may be shown illustrated in the example.

Exercises: You may wish to have students give orally t multiplication facts that they used to find the quotien

Working Together

Complete.

1. For $2\overline{)60}$, $2 \times \square = 6$
   $2 \times \square$ tens $= 6$ tens
   $2 \times \square = 60$
   $2\overline{)60}$

2. For $8\overline{)560}$, $8 \times \square = 56$
   $8 \times \square$ tens $= 56$ tens
   $8 \times \square = 560$
   $8\overline{)560}$

Give a multiplication fact that can be used to find the quotient.

Example: For $5\overline{)450}$, use $\boxed{5 \times 9 = 45,}$
5×9 tens $= 45$ tens, or
$5 \times 90 = 450$.

3. $4\overline{)80}$ (4×2=8) 4. $7\overline{)210}$ (7×3=21) 5. $6\overline{)300}$ (6×5=30)

Divide. Give the multiplication fact you use.

6. $3\overline{)90}$ (3×3=9, 30) 7. $9\overline{)360}$ (9×4=36, 40) 8. $5\overline{)300}$ (5×6=30, 60)

Exercises

Divide.

1. $3\overline{)60}$ 20 2. $4\overline{)240}$ 60 3. $2\overline{)40}$ 20
4. $5\overline{)150}$ 30 5. $3\overline{)30}$ 10 6. $4\overline{)160}$ 40
7. $7\overline{)280}$ 40 8. $6\overline{)360}$ 60 9. $3\overline{)240}$ 80
10. $4\overline{)200}$ 50 11. $9\overline{)180}$ 20 12. $5\overline{)100}$ 20
13. $8\overline{)320}$ 40 14. $5\overline{)350}$ 70 15. $8\overline{)480}$ 60
16. $7\overline{)70}$ 10 17. $6\overline{)540}$ 90 18. $7\overline{)490}$ 70
19. $8\overline{)240}$ 30 20. $9\overline{)450}$ 50 21. $5\overline{)400}$ 80
22. $2\overline{)100}$ 50 23. $7\overline{)560}$ 80 24. $4\overline{)360}$ 90
25. $9\overline{)720}$ 80 26. $6\overline{)420}$ 70 27. $7\overline{)630}$ 90

Solve.

28. Angus used to have 4 bags for 120 marbles. If he kept the same number of marbles in each bag, how many were in each bag? 30

29. Joy had 20 marbles. She gave 2 to each friend. How many friends got marbles? 10

Subtract.

1.	2.	3.	4.	5.	6.
463	3280	4161	3024	802	7000
285	748	3965	1446	233	4215
178	2532	196	1578	569	2785

Use >, <, or = to make true statements.

7. $1359 - 682 \bigcirc 1234 - 567$ >
8. $788 + 788 \bigcirc 2364 - 788$ =
9. $5555 - 777 \bigcirc 2222 + 2468$ >
10. $4000 - 739 \bigcirc 3271$ <
11. $1563 + 437 \bigcirc 9070 - 7070$ =
12. $2452 - 888 \bigcirc 1546$ >
13. $789 - 456 \bigcirc 987 - 654$ =
14. $999 + 999 \bigcirc 1999$ <
15. $6957 + 2798 \bigcirc 2798 + 6975$ <

KEEPING SHARP

Note that both the partitive aspect (Ex. 28) and the measurement aspect (Ex. 29) of division are included.

eping Sharp: These exercises help to maintain the skills of addition and subtraction with regroupings. If necessary, review the symbols < for "is less than" and > for "is greater than". For Ex. 15, ask the students whether it is necessary to perform the additions to determine which symbol makes the sentence a true statement.

sessment

vide.

1. $8\overline{)400}$ 50 2. $7\overline{)140}$ 20 3. $3\overline{)240}$ 80 4. $6\overline{)180}$ 30

RELATED ACTIVITIES

- Students may work in pairs such that one student writes any basic division fact and the other student writes the corresponding extension for a multiple of ten, for example,

$$\begin{array}{r} 5 \\ 7\overline{)35} \end{array} \qquad \begin{array}{r} 50 \\ 7\overline{)350} \end{array}$$

The roles may be reversed after several exercises and the order in which the facts are shown may vary. You may also choose to have the students show a multiplication fact related to each division.

$7 \times 5 = 35$ $7 \times 50 = 350$

Pages 144-145

LESSON OUTCOME

Find the quotient and the remainder, divisors and quotients to 9

Vocabulary

remainder, prime number

Prerequisite Skills

Complete basic division facts and show the multiplication fact that is used; subtract, minuends to 89

Checking Prerequisite Skills

Divide. Show the multiplication fact you used. $6 \times 7 = 42$ $5 \times 4 = 20$

1. $6\overline{)42}$ 7
2. $5\overline{)20}$ 4
3. $8\overline{)16}$ 2 $8 \times 2 = 16$
4. $9\overline{)9}$ 1 $9 \times 1 = 9$

Subtract.

5. $\begin{array}{r} 43 \\ -\ 36 \\ \hline 7 \end{array}$
6. $\begin{array}{r} 20 \\ -\ 18 \\ \hline 2 \end{array}$
7. $\begin{array}{r} 61 \\ -\ 56 \\ \hline 5 \end{array}$
8. $\begin{array}{r} 34 \\ -\ 28 \\ \hline 6 \end{array}$

Remainders

Geoffrey has 27 rocks and 4 trays. He wants to place the same number of rocks on each tray. How many should he place on each tray? How many rocks will be left over?

Divide 27 by 4.

For $4\overline{)27}$,

think $4 \times 6 = 24$
$4 \times 7 = 28$ . . . too many!

Write $4\overline{)27}$ $\begin{array}{r} 6 \\ 24 \\ \hline 3 \end{array}$

6 — rocks for each tray
24 — rocks used
3 — rocks left over

Geoffrey should place 6 rocks on each tray. There will be 3 left over.

In division, the number left over is the **remainder**.

For $4\overline{)27}$, here is another way to show that the quotient is 6 and the remainder is 3.

$$4\overline{)27} \quad 6 \text{ R3}, \quad 24, \quad 3$$

Working Together

Give the multiplication fact that you would use to find the quotient.

Example: For $7\overline{)44}$,

$7 \times 6 = 42$
$7 \times 7 = 49$ . . . too great!

Use $7 \times 6 = 42$.

1. $3\overline{)8}$ $3 \times 2 = 6$
2. $6\overline{)27}$ $6 \times 4 = 24$
3. $8\overline{)52}$ $8 \times 6 = 48$

Divide. Show the quotient and the remainder.

4. $2\overline{)9}$ 4 R1
5. $5\overline{)37}$ 7 R2
6. $9\overline{)33}$ 3 R6

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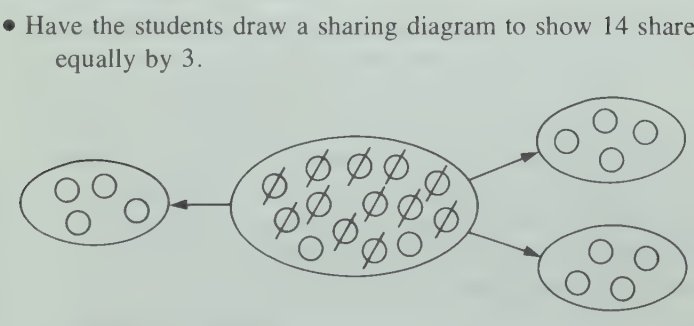
LESSON ACTIVITY

Before Using the Pages

- Have the students draw a sharing diagram to show 14 shared equally by 3.



Discuss the fact that although there will be 4 in each group, there will also be 2 left over. Use other examples as needed.

Using the Pages

- The worked example illustrates that some division situations involve amounts left over. Briefly discuss the photograph.

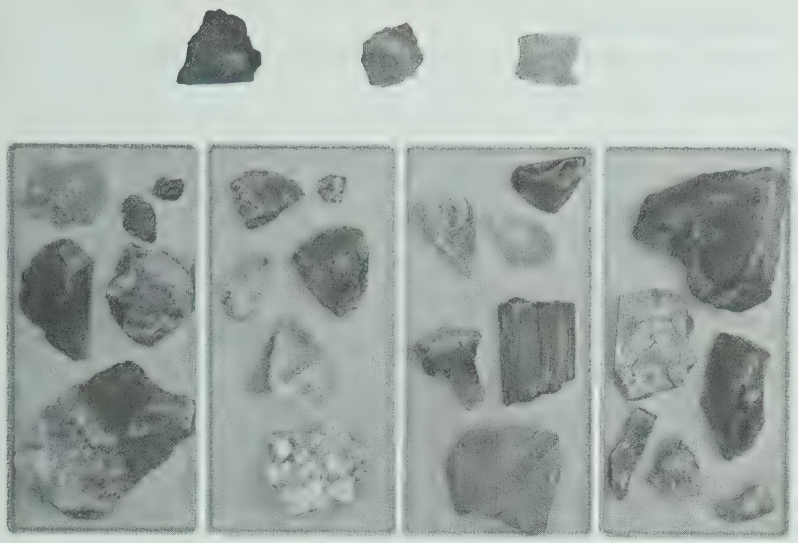
Encourage students who have their own rock collections tell about them and perhaps to identify some of the roc illustrated.

Lead the students through the solution to Geoffre problem. Emphasize the thought process suggested by t "thought cloud" in which multiplication facts are cons ered in sequence until a product is too great. You may wi to show a four-times table on the board to help demonstra that $4 \times 6 = 24$ is the best fact to use.

×	1	2	3	4	5	6	7	8	9
4	4	8	12	16	20	24	28	32	36

27

Draw the students' attention to the word *remainder* describe the amount left over. Ask what operation is used find the remainder. Finally, discuss the format for t division shown at the bottom of page 144. Ask how t numbers 24 and 3 are derived, what name is given to the and what name is given to the 3.



Exercises

Divide. Show the quotient and the remainder.

1. $4\overline{)9}$ 2 R1	2. $7\overline{)24}$ 3 R3	3. $3\overline{)10}$ 3 R1
4. $4\overline{)38}$ 9 R2	5. $6\overline{)47}$ 7 R5	6. $8\overline{)23}$ 2 R7
7. $5\overline{)24}$ 4 R4	8. $3\overline{)20}$ 6 R2	9. $7\overline{)57}$ 8 R1
10. $9\overline{)43}$ 4 R7	11. $6\overline{)42}$ 7 R0	12. $2\overline{)19}$ 9 R1
13. $6\overline{)34}$ 5 R4	14. $8\overline{)61}$ 7 R5	15. $9\overline{)53}$ 5 R8
16. $7\overline{)55}$ 7 R6	17. $5\overline{)23}$ 4 R3	18. $8\overline{)24}$ 3 R0
19. $9\overline{)20}$ 2 R2	20. $8\overline{)66}$ 8 R2	21. $6\overline{)20}$ 3 R2
22. $9\overline{)54}$ 6 R0	23. $7\overline{)34}$ 4 R6	24. $9\overline{)10}$ 1 R1

A number greater than 1 is a **prime number** if it has only two factors, itself and 1.

Example: 5 is a prime number. Its only factors are 5 and 1.

$5 \times 1 = 5$ $\quad 1 \times 5 = 5$

Show why these are not prime numbers.

1. 6 ($2 \times 3 = 6$)
2. 15 ($3 \times 5 = 15$)
3. 16 ($4 \times 4 = 16$)
4. 20 ($4 \times 5 = 20$)
5. 42 ($6 \times 7 = 42$)
6. 22 ($2 \times 11 = 22$)

Which of these are prime numbers?

7. 11 — prime
8. 7 — prime
9. 9 — not prime
10. 17 — prime
11. 2 — prime
12. 35 — not prime

try this

RELATED ACTIVITIES

• The device described in the second activity of *Related Activities* on page T131 may be adapted for practicing division with remainders. However, avoid the number zero in either of the two circles. Do not write a numeral in the smallest circle.

$$9\overline{)30} \quad 3 \text{ R3}$$
$$\underline{27}$$
$$3$$

By turning one of the circular shapes, a new set of division exercises is obtained.

• Students may find completing divisions, similar to the following, of interest for the patterns that result (shown below in short form).

$4\overline{)1}$ 0 R1	$4\overline{)2}$ 0 R2	$4\overline{)3}$ 0 R3
$4\overline{)4}$ 1 R0	$4\overline{)5}$ 1 R1	$4\overline{)6}$ 1 R2
$4\overline{)7}$ 1 R3	$4\overline{)8}$ 2 R0	$4\overline{)9}$ 2 R1
$4\overline{)10}$ 2 R2	$4\overline{)11}$ 2 R3	$4\overline{)12}$ 3 R0

For division by 4, emphasize that a remainder is never greater than 3.

• You may wish to have students find prime numbers less than 100, as described on page T346.

king Together: Ex. 1-3 concentrate on the skill of relating the division to the most appropriate multiplication fact. It is important to discuss the students' answers and question them as to the reason for selecting the particular facts. For example, for Ex. 1, $3 \times 2 = 6$ is best because the next fact in the three-times table is $3 \times 3 = 9$, and 9 is too great for $3\overline{)8}$. Ex. 4-6 concentrate on the format for showing the division and the remainder. Use other similar examples.

rcises: Students who are as yet uncertain of some multiplication facts may need to refer to the multiplication table on page 134 for assistance. Note that an example like Ex. 18 demonstrates that 0 may be considered a remainder. Discuss this and other similar examples to emphasize that the remainder is zero rather than saying that there is no remainder.

This: Students apply their knowledge of factors and products in determining whether a number is *prime*. It may be necessary to complete Ex. 1 with the students to clarify why 6 is not a prime number:

2 and 3 are factors of 6, since $2 \times 3 = 6$;
1 and 6 are factors of 6, since $1 \times 6 = 6$.

Thus, 6 has four different factors. A prime number has only two different factors, itself and 1.

Assessment

Divide. Show the quotient and the remainder.

1. $6\overline{)17}$ 2 R5
2. $3\overline{)14}$ 4 R2
3. $8\overline{)50}$ 6 R2
4. $9\overline{)75}$ 8 R3

Page 146

OBJECTIVE

Write an equation to match a word problem

Vocabulary

equation

RELATED ACTIVITIES

- For further practice, students may write equations for word problems selected from pages of the previous units. The following are suitable examples.

Page	Exercises
55	22-25
93	2, 4
137	19-23
139	1-4

- Provide students with a list of number sentences. Have them ring those which are equations.

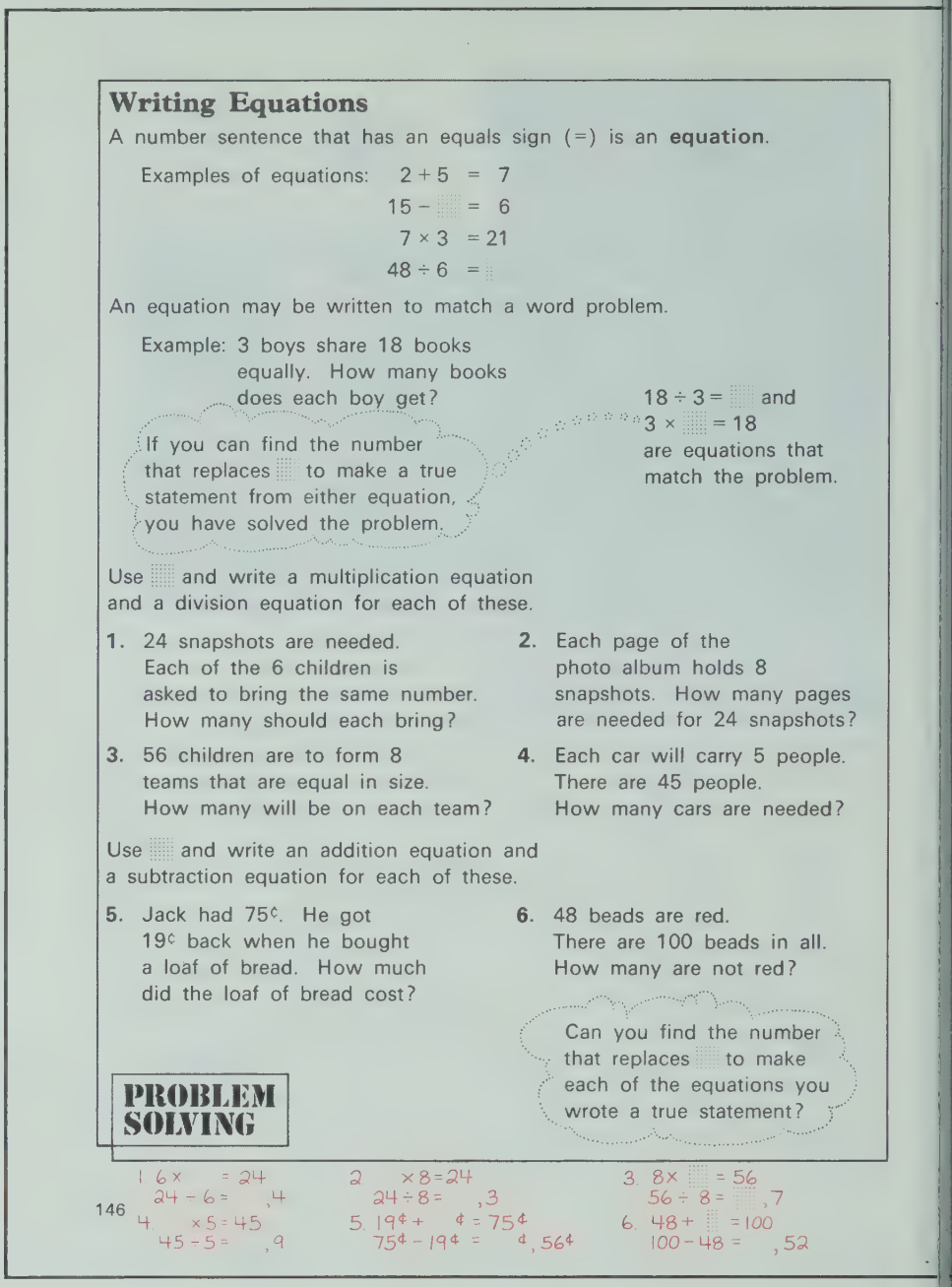
$4 + 7 = 11$

$3 + 6 < 11$

- Provide students with a list of equations. Have them identify those which are true statements.

$6 \times 2 = 11$ F

$12 - 4 = 8$ T



Writing Equations

A number sentence that has an equals sign (=) is an **equation**.

Examples of equations: $2 + 5 = 7$

$15 - \square = 6$

$7 \times 3 = 21$

$48 \div 6 = \square$

An equation may be written to match a word problem.

Example: 3 boys share 18 books equally. How many books does each boy get?

If you can find the number that replaces $\square$ to make a true statement from either equation, you have solved the problem.

$18 \div 3 = \square$ and $3 \times \square = 18$ are equations that match the problem.

Use $\square$ and write a multiplication equation and a division equation for each of these.

1. 24 snapshots are needed. Each of the 6 children is asked to bring the same number. How many should each bring?
2. Each page of the photo album holds 8 snapshots. How many pages are needed for 24 snapshots?
3. 56 children are to form 8 teams that are equal in size. How many will be on each team?
4. Each car will carry 5 people. There are 45 people. How many cars are needed?

Use $\square$ and write an addition equation and a subtraction equation for each of these.

5. Jack had 75¢. He got 19¢ back when he bought a loaf of bread. How much did the loaf of bread cost?
6. 48 beads are red. There are 100 beads in all. How many are not red?

Can you find the number that replaces $\square$ to make each of the equations you wrote a true statement?

PROBLEM SOLVING

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1. $6 \times \square = 24$, $24 - 6 = \square$, 4
2. $\square \times 8 = 24$, $24 \div 8 = \square$, 3
3. $8 \times \square = 56$, $56 \div 8 = \square$, 7
4. $\square \times 5 = 45$, $45 \div 5 = \square$, 9
5. $19¢ + \square¢ = 75¢$, $75¢ - 19¢ = \square¢$, 56¢
6. $48 + \square = 100$, $100 - 48 = \square$, 52

LESSON ACTIVITY

Using the Page

- Read the statement and the four examples to introduce the term *equation* to the students. Have several students write other examples of equations on the board. Continue with the word problem in the example. Discuss that a sharing situation involves division and point out the division sentence. Review that the equation beneath this is a multiplication sentence. Write the multiplication sentence $2 \times 4 < 11$ and ask whether this sentence is an equation. Have a student give the reason.

  The statement in the "thought cloud" should be discussed in relation to the two sentences. For example, replace the $\square$ with the number 7 to show $18 \div 3 = 7$ on the board, and ask,

  "Is the sentence an equation?" (Yes)

  "Does the sentence show a true statement?" (No)

  "What number makes the two statements true?" (6)

Assign the exercises and, if necessary, work Ex. 1 the students to ensure that they understand what is requi After they finish Ex. 6, they may replace each place ho with a number to make a true statement.

Checking Up

Write the complete family of facts for each group of numbers.

1. $3 \times 7 = 21$ $7 \times 3 = 21$ $3\overline{)21}$ $7\overline{)21}$

2. $4\overline{)36}$ $4 \times 9 = 36$ $9\overline{)36}$ $9 \times 4 = 36$

3. $6\overline{)30}$ $5\overline{)30}$ $6 \times 5 = 30$ $5 \times 6 = 30$

4. 8, 3, and 24 $8 \times 3 = 24$, $3 \times 8 = 24$, $8\overline{)24}$, $3\overline{)24}$

5. 2, 18, and 9 $2 \times 9 = 18$, $9 \times 2 = 18$, $2\overline{)18}$, $9\overline{)18}$

6. 49, 7, and 7 $7 \times 7 = 49$, $7\overline{)49}$

Divide. Show the multiplication fact you use.

7. $4\overline{)12}$ $4 \times 3 = 12$

8. $3\overline{)27}$ $3 \times 9 = 27$

9. $8\overline{)32}$ $8 \times 4 = 32$

10. $2\overline{)14}$ $2 \times 7 = 14$

11. $9\overline{)27}$ $9 \times 3 = 27$

12. $8\overline{)40}$ $8 \times 5 = 40$

13. $6\overline{)36}$ $6 \times 6 = 36$

14. $5\overline{)45}$ $5 \times 9 = 45$

15. $7\overline{)42}$ $7 \times 6 = 42$

16. $6\overline{)54}$ $6 \times 9 = 54$

Write the quotient.

17. $4\overline{)24}$ **18.** $6\overline{)12}$ **19.** $2\overline{)10}$ **20.** $5\overline{)30}$ **21.** $3\overline{)9}$

22. $8\overline{)64}$ **23.** $4\overline{)20}$ **24.** $9\overline{)63}$ **25.** $7\overline{)56}$ **26.** $9\overline{)36}$

27. $3\overline{)180}$ **28.** $9\overline{)720}$ **29.** $5\overline{)400}$ **30.** $8\overline{)560}$ **31.** $7\overline{)280}$

Solve. Show each division.

32. The product is 15. One factor is 3. What is the other factor? $3\overline{)15}$

33. One factor is 5. The product is 35. What is the other factor? $5\overline{)35}$

34. Marcel shared 42 seeds equally among 6 packets. How many seeds did he put into each packet? $6\overline{)42}$

35. Phyllis collects stamps in blocks of 4. She has 32 stamps. How many blocks does she have? $4\overline{)32}$

Divide. Show the quotient and the remainder.

36. $3\overline{)26}$ **37.** $6\overline{)28}$ **38.** $2\overline{)13}$ **39.** $5\overline{)26}$ **40.** $7\overline{)27}$

41. $9\overline{)50}$ **42.** $4\overline{)31}$ **43.** $8\overline{)55}$ **44.** $7\overline{)32}$ **45.** $4\overline{)10}$

Solve.

46. Myrna had 37 badges. She gave 5 to each friend. How many friends got 5 badges? How many extra badges were there?

47. The 50 seashells were shared equally by 6 girls. How many shells did each girl get? How many extra shells were there?

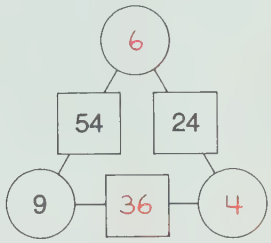
Page 147

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Have the students complete diagrams similar to the following. Factors are shown in the circles. Products are shown in the squares.



- Students may play a variation of the game Bingo. Each student prepares a 4-by-4 game card and writes any of the numerals 1 to 9 in any order on the card. Division fact cards are used by the caller. As each division is called, players place a marker on their cards if the corresponding quotient is shown. The first player with 4 markers in line wins and takes the place of the caller.

9	5	4	8
2	1	3	4
9	6	8	7
7	5	6	2

$12 \div 4$

lls	Exercises	Related Pages
ite the family of multiplication nd division facts	1-6	T 142-T 143
e multiplication to divide	7-16	T 144-T 145
		T 146-T 147
mplete basic division facts	17-26	T 148-T 149
ide a multiple of ten by a ne-digit number	27-31	T 152-T 153
d quotients and remainders	36-45	T 154-T 155
ve division problems	32-35	
	46,47	

Comments

Determine whether errors are due to difficulties with division, with multiplication, or with relating division and multiplication. Since division is the inverse of multiplication, reviewing multiplication facts can reinforce an understanding of division concepts.

Choose from the many activities and games suggested in Units 5 and 6 to provide further practice.

Unit 7 Overview

Geometry and Graphing

This unit deals primarily with congruency of shapes as it is determined by means of motions. Unit 4 dealt with this concept through tracings applied to shapes in an informal manner. In this unit, however, the tracings are used according to specific guidelines which govern the motions of the slide, flip, and turn. Flip lines which are encountered in flips are examined in relation to symmetry and are also identified as lines of symmetry. An informal introduction to coordinate geometry is provided through a study of ordered pairs of numbers as they are used to locate regions on a map and points on a grid. The unit also includes drawing pictographs, drawing bar graphs, and reading scales on which only key numerals are provided with the markings. The unit concludes with a review and check-up of the concepts and skills presented and also with an assessment of skills in addition, subtraction, multiplication, and related problem solving.

Prerequisite Skills

- complete number patterns

Unit Outcomes

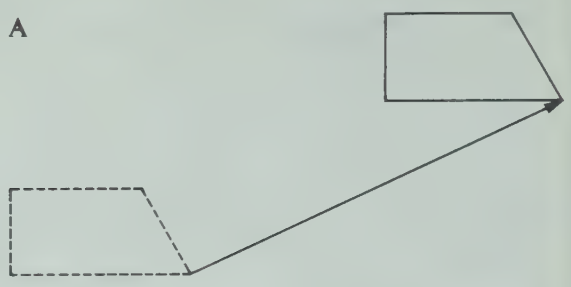
- apply a slide, flip, or turn using tracing paper to identify congruent shapes on a grid
- identify one figure as the slide image of another figure for a given slide arrow
- identify one figure as the flip image of another figure in a given flip line
- identify one figure as the turn image of another figure for a given turn center and turn arrow (quarter turns, half turns, and three-quarter turns)
- identify lines of symmetry using flip lines
- match ordered pairs with regions on a map and with points on a grid
- draw a pictograph to display information
- draw a bar graph to display information
- read a scale to obtain necessary information

Background

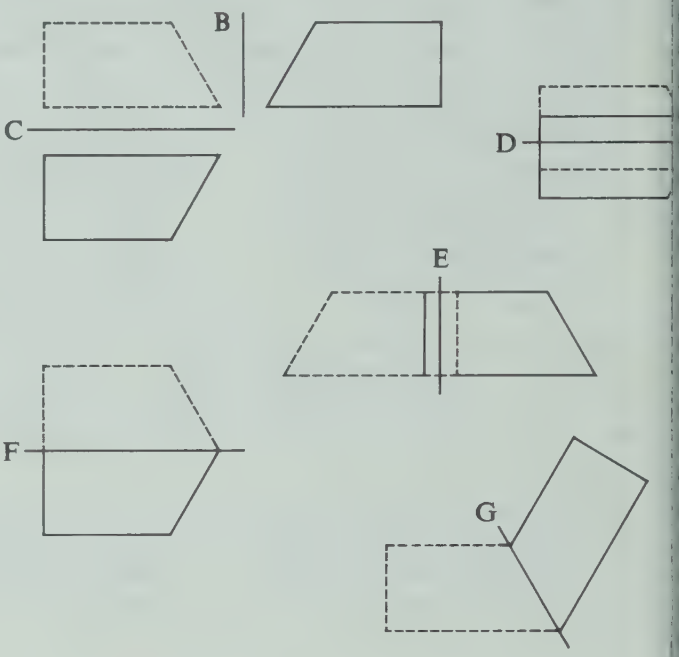
In Unit 4, the term *congruent* was presented as signifying that figures have the same size and shape. This was established through the use of tracings by which the lengths of sides and sizes of angles were compared. In effect, congruency was established through an informal method of measuring these features. In this unit, congruency is determined by noting whether a tracing of the original shape can be moved to match another shape. This is known as *transformation geometry*, or informally, *motion geometry*. Although the concept is not new, it has been found to be particularly effective as a means for young children to study congruency, since it uses visual and manipulative experiences, rather than abstract reasoning.

Three basic transformations are studied: the *translation* (slide), the *reflection* (flip), and the *rotation* (turn). The less formal terms shown in parentheses are used since they are more meaningful to young children. The transformations are discussed here for the teacher's benefit, but for the students, the emphasis should be on the actions involved.

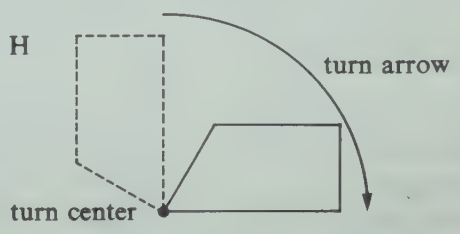
All the motions presented at this level occur in one plane, in other words, on a flat surface. A slide can occur along any straight line and the orientation of the shape is not changed. the direction and the length of the slide may be indicated slide arrow (A).



A shape can be flipped about a line, and the image is reverse of the original shape. Thus, orientation of the shap changed by a flip. The flip line may be outside the shape (B C), inside the shape (D and E), or on the shape itself (F and

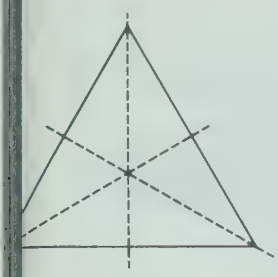


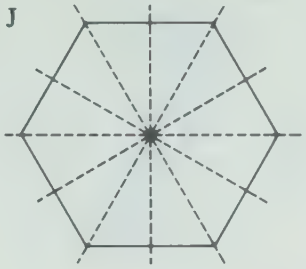
A shape can be turned using any point as a turn center. Ag the turn center may be outside, inside, or on the shape. At level, however, only turn centers on the shape are conside The direction and amount of turning may be indicated wi turn arrow (H). The orientation of the shape is altered accor to the amount of rotation.



The two topics of flip image and line symmetry are prese in close succession because they tend to support each o Flipping a figure about a line produces an identical but reve image, and the two parts together make a symmetrical fig Similarly, a shape that possesses line symmetry has matching halves, one on either side of the line of symm Some shapes have more than one line of symmetry. example, an equilateral triangle (I) has three lines of symm

a regular hexagon (J) has six lines of symmetry. It is esting to note that in regular polygons, the number of lines mmetry is the same as the number of sides, and they all sect at one point.





basic feature of coordinate geometry is the identification of ons and points in a plane by means of a pair of symbols. y students at this level probably have seen maps with erals and letters around their edges, but they may not have ally used them to locate places. On a map, regions are lly named by ordered pairs consisting of a letter and a ber, as in (M,5). On a grid, ordered pairs consisting of two bers name points where grid lines intersect. To avoid any usion, it is universally accepted that the first number of an red pair refers to the horizontal distance from the starting t (0,0), and the second number refers to the vertical distance the same starting point. Briefly, one counts *over* first and *up* from zero, hence, the term *ordered pair*. Thus, (2,3) and name different points because the order of the numbers in pair is different.

Unit 5, a pictograph was presented and students probably preted it without difficulty. Drawing pictographs is much e involved, however, since a number of decisions must be e with respect to titles, headings, symbols, and their values. hese, the last two are probably the most difficult. Poorly en symbols and unit values for them can result in either too y symbols or an inability to adapt the symbols to represent r values. Drawing bar graphs involves similar consid- ons, and the skills required for both types of graphs are best ired through actually making them. In these cases, rience is the best teacher.

eading a scale on which not all the marks are numbered ires a preliminary study to determine the value of each val on the scale. If, for example, there are five divisions on ale from 0 to 10, each interval represents a value of 2; if e are five divisions on a scale from 0 to 50, however, then interval has a value of 10. Only after the values have been rmined can the scales be read with meaning. Accuracy in ng scales, therefore, is dependent on knowing the value of interval and on counting the intervals correctly. With rience, these two skills may reach the level of subconscious tification by visually noting the relative position of a cular point to the named points. For example, a quick ce at the scale shown below suggest units of 1 and an cated position of 7.

milarly, many people can read time on a dial clock on which are no numerical symbols. With experience they have ed the positions of the numerals; that is, they do not need to ify the units, nor do they need to count.

Teaching Strategies

This unit offers another change from the study of numbers and operations. Several methods of grouping and regrouping students may be used for the lessons. For example, although students may have different abilities in work with numbers, they may still enjoy sharing their experiences in tracing shapes and testing for congruency of figures. It is advisable for the students to demonstrate and to discuss together their procedures in doing the exercises in the unit. It is also important for the teacher to observe the students in these sessions; it may be necessary to guide them in developing an understanding of the concepts, terms, and symbols, and in performing the transformations properly. It is suggested that the teacher work with small groups of ten or fewer students. While one group works with the teacher, others may be engaged in doing practice exercises in the four basic operations, in solving word problems, or in carrying out some of the suggestions in the *Related Activities* for lessons which have been completed. Three sets of *Keeping Sharp* exercises are provided on pages 159, 163, and 165, and four sets of exercises are offered at the end of the unit on pages 172 and 173. Still another way to restructure the program is possible by changing the order of the topics in the unit. If the lessons at the end of the unit on maps, ordered number pairs, and graphing are presented first, the follow-up activities may engage some groups while the teacher works with others on transformations.

The study of motion geometry and symmetry can be integrated with other subject areas such as physical education, art, and science. Students can use body motions to demonstrate slides, flips, and turns in the gym. Building pyramids provides real experience with symmetry. Transformations of shapes may be used to make pleasing and interesting patterns in art. Designs on wallpaper and on printed fabrics may be examined and their patterns described in the language of motion geometry. Line symmetry in nature may be found in the shapes, outlines, and markings of butterflies, birds, flowers, and snowflakes.

A table or mathematics center in one area of the classroom is recommended to keep a supply of graph paper and tracing paper for students to use. It can also have sets of activity cards for performing some of the activities described in the *Related Activities* of the lesson outlines. Other materials in the center could be samples of wallpaper and fabric, pictures of road symbols, pictures of commercial logos which have line symmetry, copies of pages T 353 - T 356 (regular and irregular polygons), maps, and plexiglass mirrors.

Materials

copies of page T 367 for each student; tracing paper
straight edge, pin, and sharp pencil for each student
overhead projector or large graph paper
shapes and objects for showing motions
maps of different cities (optional)
a red and a blue crayon for each student

Vocabulary

motion, slide, flip, turn
slide arrow, slide image
flip line, flip image
"key" point, turn arrow
turn center, turn image
region
grid
number pair
pictograph
bar graph

LESSON OUTCOME

Apply a slide, flip, or turn using tracing paper to identify congruent shapes on a grid

Materials

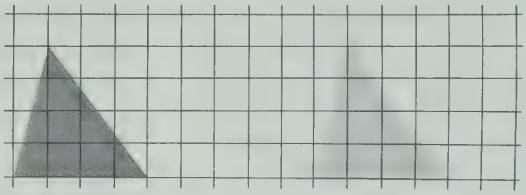
four-by-seven section of graph paper (use copies of page T 367), a red and a blue crayon and tracing paper for each student; overhead projector (optional)

Vocabulary

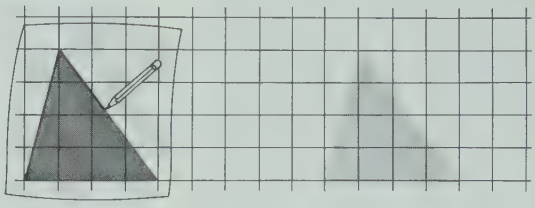
motion, slide, flip, turn

Motions for Matching Congruent Shapes

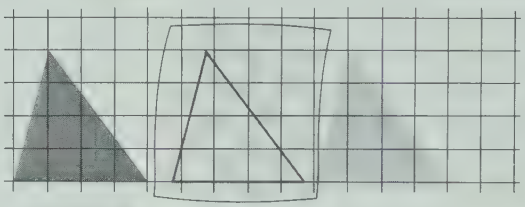
If a tracing of one shape matches a second shape, the shapes are congruent.



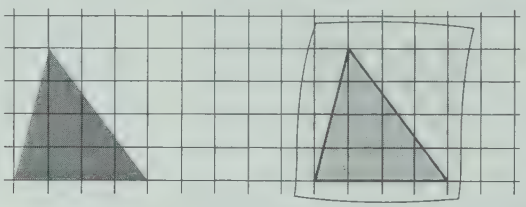
Trace the red shape.



Slide the tracing.



The tracing matches the blue shape.



The red shape and the blue shape are congruent.

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LESSON ACTIVITY

Before Using the Pages

- Give each student a four-by-seven section of graph paper cut from copies of page T 367. Have the students cut along grid lines to obtain the following shape of the letter E. Have them color one side of the shape red and the reverse side blue. Have them place the shapes on their desks and move them according to your instructions. (If you wish, the activity may be demonstrated on the overhead projector as the students work.) Give instructions such as the following. Show a red E. Slide the shape on your desk, but always show a red E (this motion will be a slide because the shape will not appear as the letter E if it is turned, nor will it be red if it is flipped). Hold one finger anywhere on the red E and slowly move it to show a red M, then a red W, then a red numeral 3 (these motions will be turns). Ask "How can we change from red to blue?" (This motion will be a f Show a red E and flip it over to show a blue 3. Show a r and flip it another way to show a blue E. Elicit the w *slide*, *flip*, and *turn* from the students in having t describe the ways of moving the shape. You may wis have them keep these shapes for use in the first activit *Related Activities*. Establish that although the paper sl is moved to different positions, size and shape rem unchanged.

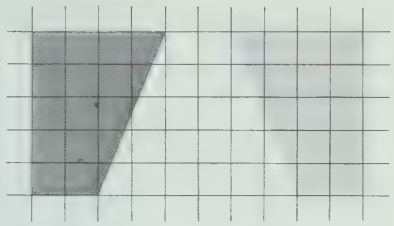
Using the Pages

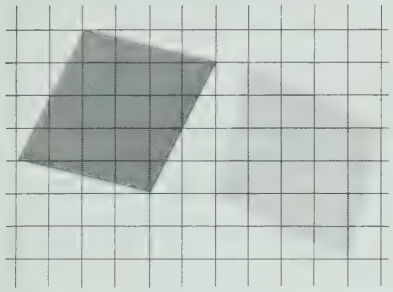
- Review the meaning of "congruent shapes" (see the head for this lesson). Emphasize that both the shape and the of figures must be the same for them to be congruent. L the students through the sequence of illustrations that s that the red shape and the blue shape are congruent beca they can be matched by sliding a tracing. Then give students tracing paper to carry out the same procedure the first illustration. Emphasize that the shape must mov a straight path for a slide (and thus it does not turn).

Working Together

Use tracing paper.

1. Trace the red shape.
2. Can you slide the tracing to match the blue shape? no
3. Flip your tracing over. Can you match the tracing and the blue shape? yes
4. Are the red shape and the blue shape congruent? yes



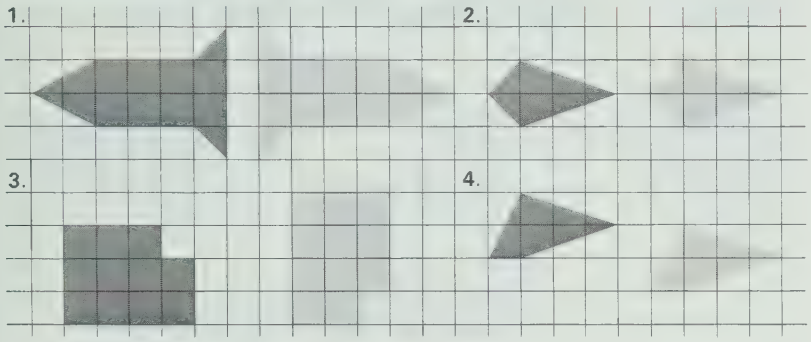


5. Trace the red shape.
6. Can you slide the tracing to match the blue shape? no
7. Can you flip the tracing to match the blue shape? no
8. Turn your tracing. Can you match the tracing and the blue shape? yes
9. Are the red shape and the blue shape congruent? yes

Exercises

Trace the red shape. Try to slide, flip, or turn the tracing to match it and the blue shape. If they match, tell which motion you used.

1. flip or turn
2. slide
3. turn
4. slide



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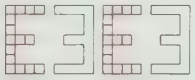
RELATED ACTIVITIES

• The figures that the students cut out for the activity in *Before Using the Pages* can be used to review the three motions of slide, flip, and turn, and provide an interesting display of patterns. Have small groups of students paste their shapes on a large sheet of paper according to predetermined patterns. Have other students identify the patterns using the terminology introduced in the lesson.



Flip pattern

Turn, slide, turn, flip pattern

Turn, flip, turn, flip pattern

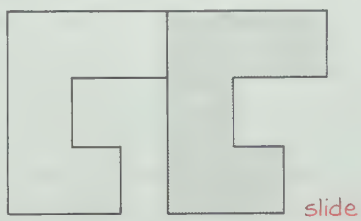
rking Together: These exercises show that congruent shapes cannot always be matched by a slide but may be matched by a flip (Ex. 1-4) or by a turn (Ex. 5-9). Let the students discover this for themselves and share their discoveries in a discussion of the exercises. In summary, review the three motions. Then have students describe each of the photographs on page 148 in terms of one of the motions. The sections of the bridge are congruent because a tracing can *slide* to show that the parts match. Similarly, one half the gable construction can *flip* to match the other half, and the Ferris wheel can *turn* to illustrate that shapes will match. Perhaps students can suggest other similar examples.

rcises: Encourage the students to see whether more than one kind of motion may be used to match pairs of congruent shapes. For example, a tracing of the red shape in Ex. 1 can be flipped or turned to match the blue shape. For these exercises, the students may find it easier to manipulate a separate, small piece of tracing paper for each exercise rather than one larger sheet for the four exercises.

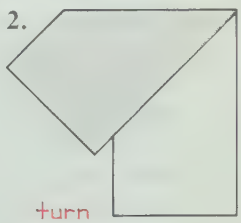
Assessment

Tell whether you can slide, flip, or turn a tracing of the white shape to match the gray shape.

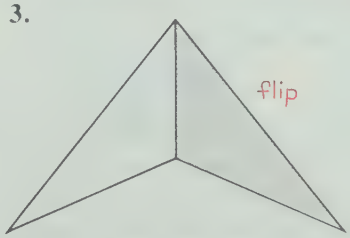
1. slide



2. turn



3. flip



Pages 150-151

LESSON OUTCOME

Identify one figure as the slide image of another figure for a given slide arrow

Materials

copies of page T 367, tracing paper, a straight edge, and a sharp pencil for each student; overhead projector or a large sheet of graph paper; shape for showing slides

Vocabulary

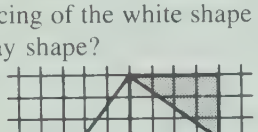
slide arrow, slide image

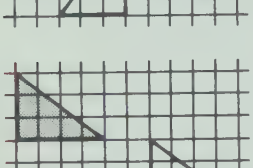
Prerequisite Skills

Identify pairs of congruent shapes that may be matched by a slide

Checking Prerequisite Skills

For which of these can you slide a tracing of the white shape to match the gray shape?

1.  no

2.  yes

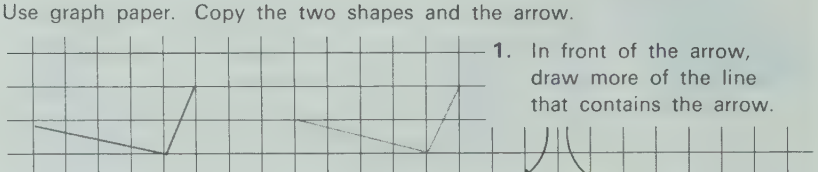
3. no

Slides

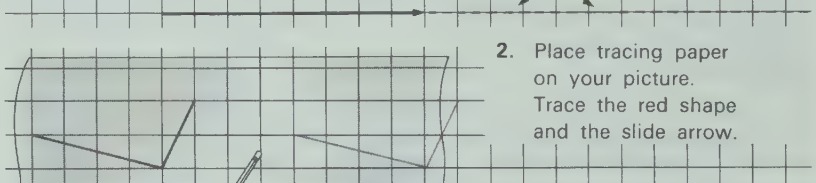
The **slide arrow** shows the direction and the distance that the toboggan slides in one second.

Working Together

Use graph paper. Copy the two shapes and the arrow.



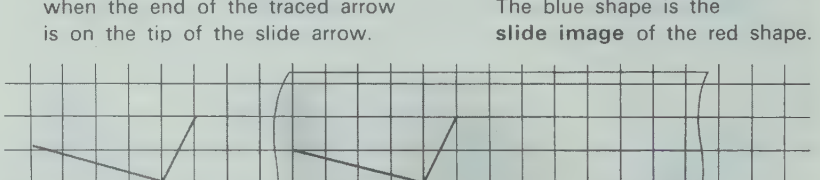
1. In front of the arrow, draw more of the line that contains the arrow.



2. Place tracing paper on your picture. Trace the red shape and the slide arrow.

3. Slide the traced arrow along the line of the slide arrow. Stop when the end of the traced arrow is on the tip of the slide arrow.

The traced shape matches the blue shape. The blue shape is the **slide image** of the red shape.



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LESSON ACTIVITY

Before Using the Pages

- Use a large sheet of graph paper or use a transparent grid on the overhead projector. Place a shape, for example, a triangle, on the grid and trace its outline. Have each of several students slide the shape a distance of three units to demonstrate that there are different directions for the slide. Have each of several students slide the shape in the same direction to show that there are different lengths possible for the slide. Ask what would have to be specified for all students to slide the shape to the same position on the grid.

Using the Pages

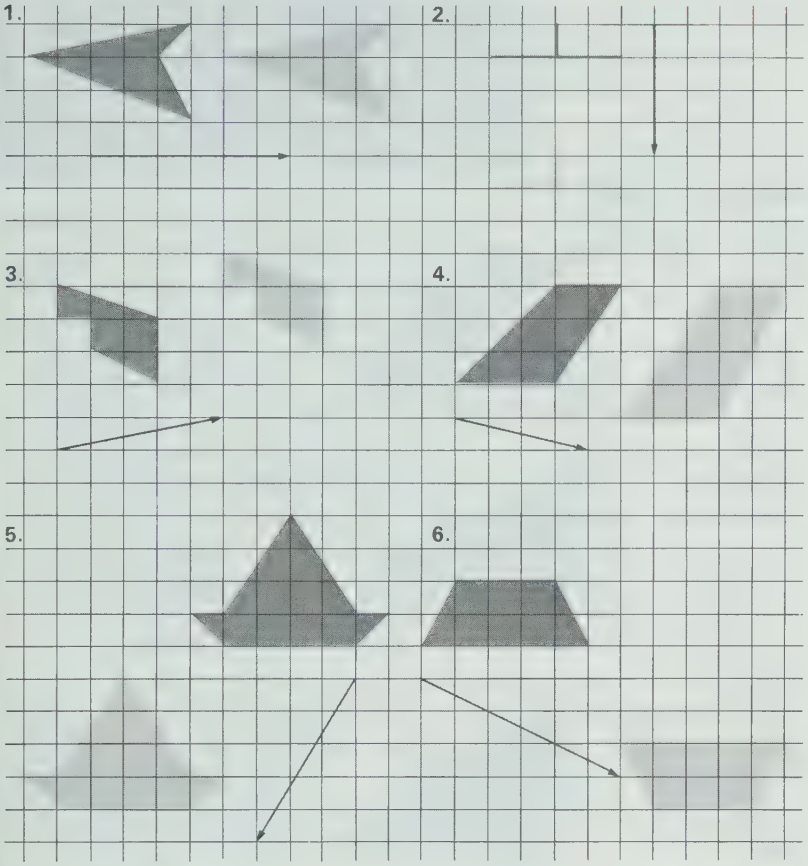
- This lesson introduces the *slide arrow* to indicate the length and the direction of a slide. The photograph provides one example of slides in everyday life and can motivate students to consider other similar examples; for instance, a drawer slides to open or shut, and you may slide a window to open or shut it. Emphasize that the arrow indicates not only the direction of a slide but also the length of the sl In this photograph, the length of the slide arrow indic the distance that the toboggan slides in one second.

Working Together: The procedure of sliding a tra according to a given slide arrow is best demonstrated o overhead projector. (If you do not have an overh projector, work with students in small groups. Stud may also work with a partner.) In advance of the les copy the shapes and the slide arrow for Ex. 1 o transparency marked with a grid. Have the stud compare this with the illustration in the text to ensure the copy is correct. Emphasize that the line containing arrow is to be extended far enough so that at least one n identical arrow can be shown. Place a clear sheet of ace over the grid and demonstrate the procedure for comple Ex. 2 and 3. Draw particular attention to ending the sl Repeat the slide action two or three times to familiarize students with the procedure. Then provide the students graph paper (copies of page T 367) and tracing paper t the exercises themselves. Introduce the term *slide imag*

Exercises

Copy the two shapes and the arrow on graph paper. Then use tracing paper to test whether the blue shape is the slide image of the red shape for the given slide arrow.

1. yes 2. yes 3. yes 4. no 5. no 6. no



Use graph paper.

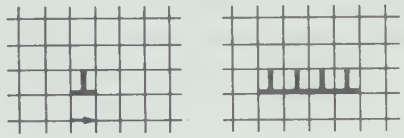
*7. Draw two congruent shapes and a slide arrow. Have a friend use tracing paper to test your picture.

151

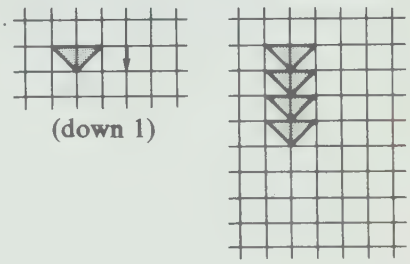
RELATED ACTIVITIES

• Have students create simple patterns based on a shape moving with respect to one or more slide arrows. Some examples are shown. Students may find it easier to trace cardboard shapes in forming the patterns.

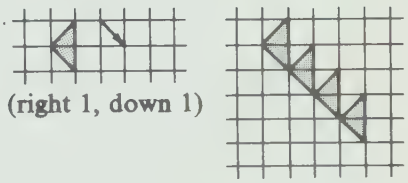
1. (right 1)



2. (down 1)



3. (right 1, down 1)



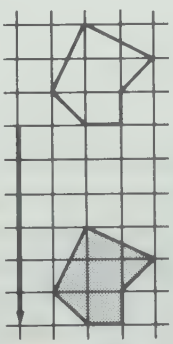
described in Ex. 3. Discuss that the slide image would be in a different position if the slide arrow were of a different length and/or in a different direction.

ercises: Advise the students to work with extra care in copying and sliding the shapes, and allow them ample time so they are not rushed. Straight edges and sharp pencils are essential for copying the shapes and slide arrows on graph paper. (Since their own graph paper is a scale different from the one on page 151, it is necessary to exercise care in copying the shapes.) The students may write the words "Yes" or "No" to indicate whether each blue shape is the slide image for the given slide. Have them give a reason (orally or in writing) for a "No" answer. For example, the slide arrow may be the wrong length and/or direction (Ex. 5), or the blue shape may not be congruent to the red shape (Ex. 4), or the red and blue shapes may be related by more than one motion (Ex. 6 involves a slide and a flip). Ex. 7 may be difficult for some students. You may modify it by having them draw one shape and a slide arrow that follows a grid line. A friend may draw the slide image.

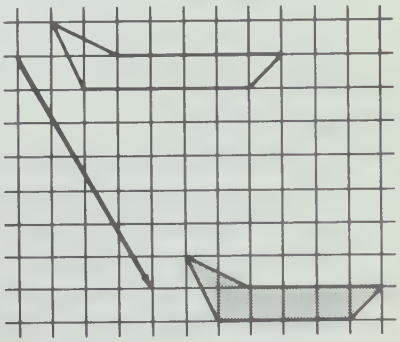
Assessment

Copy the two shapes and the arrow on graph paper. Use tracing paper to test whether the gray shape is the slide image of the white shape for the given slide arrow.

1. yes



2. no



Pages 152-153

LESSON OUTCOME

Identify one figure as the flip image of another figure in a given flip line

Materials

objects to demonstrate motions, such as the lid for a rectangular box, a key, or a postcard; copies of page T 367, tracing paper, a straight edge, and a sharp pencil for each student

Vocabulary

flip image, flip line, "key" point

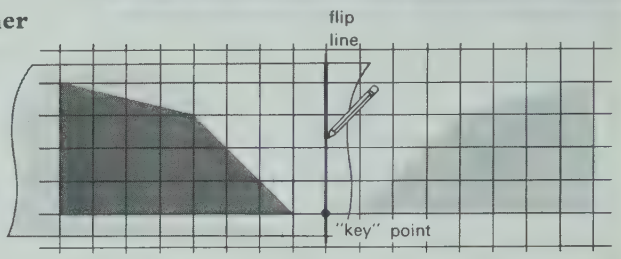
Flips

Flip this page about the line where these two pages meet . . .

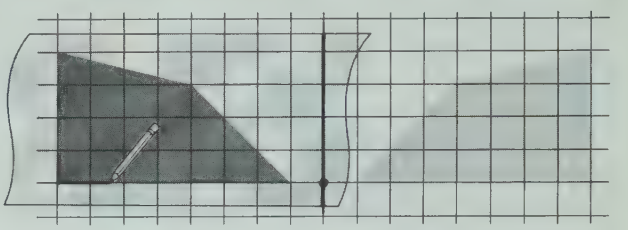
Working Together

Use tracing paper.

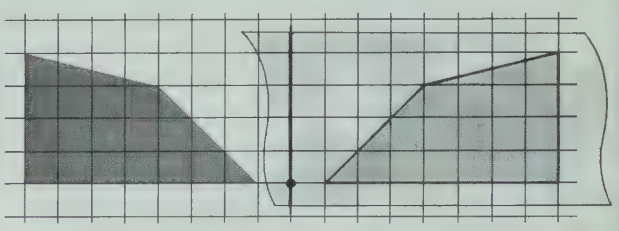
1. Trace the **flip line** and the "key" point.



2. Trace the red shape.



3. Flip the tracing over. Match the flip line and the "key" point with their tracings.



The traced shape matches the blue shape.
The blue shape is the **flip image** of the red shape.

152

LESSON ACTIVITY

Before Using the Pages

- Place an object such as the lid for a rectangular box on a table. Have students move the lid to show a slide, a flip, or a turn. Have other students identify the motion shown. Tell the students that today's lesson takes a closer look at flips.

Using the Pages

- Begin with a discussion of the photographs at the top of each of these pages. Have the students flip page 152 to meet page 153 and then flip it open again, slowly, to watch the matching parts. Introduce the term *flip line* to describe the line where the two pages meet. Ask whether one photograph would be the slide image of the other. Have a student suggest what name would describe the kind of image involved here. They will likely suggest the term *flip image*.

  Some students may recall a photograph in an earlier unit showing a flip image. Have the students turn to page 74 and describe what line is the flip line. Have them suggest ot examples of flip images.

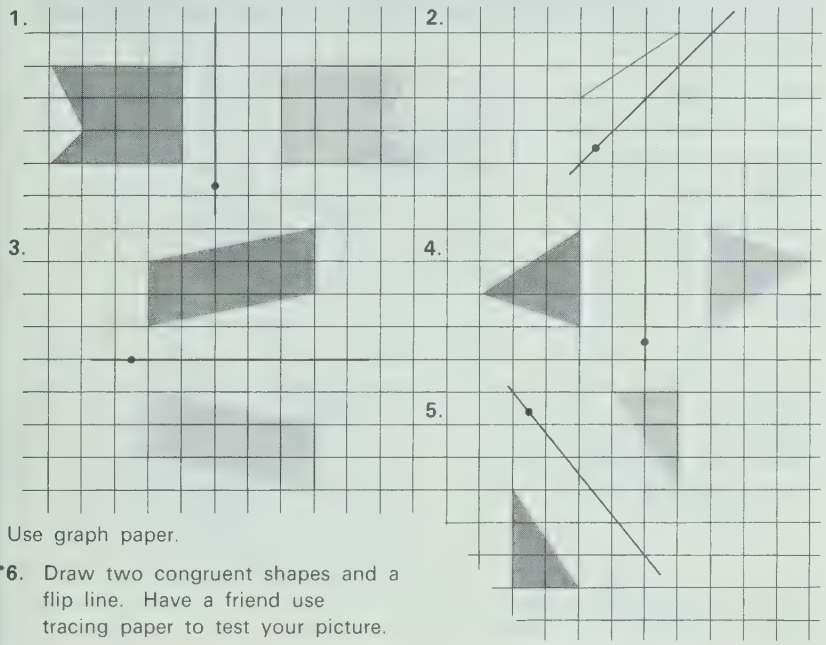
Working Together: You may wish to adapt the meth described in *Working Together* on pages T 162 and T 163 demonstrate flip images on the overhead project However, the students may be familiar enough with procedure of copying and tracing shapes to be able complete these exercises with guidance. The "key" po on the flip line is very important for helping to position tracing correctly. When the students have completed Ex. have them use their tracing to demonstrate that the b shape is not a slide image of the red shape. Discuss that direction of a flip image is reversed in relation to original shape. For example, the students are walking to right in the photo on page 152 and to the left in the photo page 153.

Exercises: Provide the students with graph paper (copies of pa T 367) and tracing paper. Remind them to copy the shap and flip lines carefully, using a straight edge and show

. . . and the two pictures will match.

Exercises

Copy these pictures on graph paper. Use tracing paper to test whether the blue shape is the flip image of the red shape for the given flip line.



Use graph paper.

*6. Draw two congruent shapes and a flip line. Have a friend use tracing paper to test your picture.

1. no 2. yes
3. yes 4. no 5. no

153

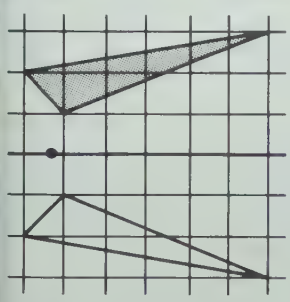
RELATED ACTIVITIES

- Have students fold a sheet of paper in half and unfold it. Have them place a small drop of ink or paint on one half, fold the sheet quickly, and press it with the palm of one hand. When the sheet is unfolded again, it will display two shapes — each the flip image of the other. The flip line is the crease of the fold. These shapes may be displayed for several days.
- Students may use a transparent plexiglass mirror along the flip lines on page 153 to see if the red and blue shapes match in each exercise.

the "key" points. Ex. 6 can challenge students in their attempt to show congruent shapes that are flip images for their chosen flip line.

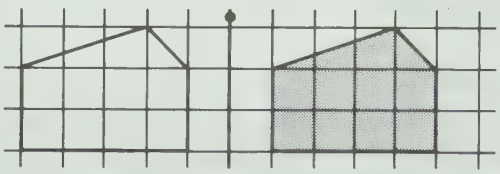
sessment

y the pictures on graph paper. Use tracing paper to test ther the gray shape is the flip image of the white shape for given flip line.



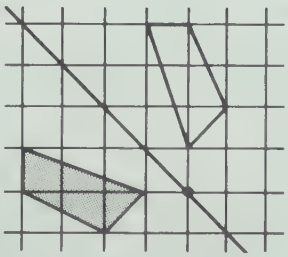
yes

2.



no

3.



yes

Pages 154-155

LESSON OUTCOME

Identify one figure as the turn image of another figure for a given turn centre and turn arrow (quarter turns, half turns, and three-quarter turns)

Materials

cardboard shape, pin; tracing paper, copy of page T 367, and a sharp pencil (or pin) for each student

Vocabulary

turn arrow, turn centre, turn image

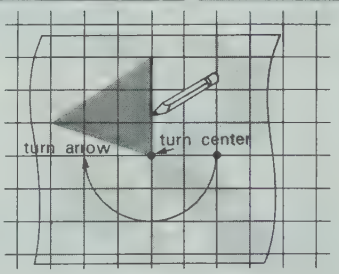
Turns

Each swing appears to turn about a point.

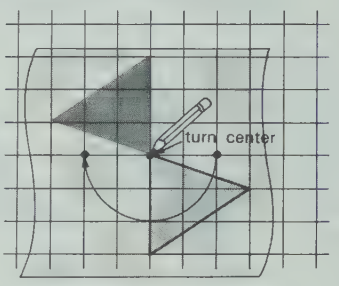
Working Together

Use tracing paper.

1. Mark a dot at the end of the **turn arrow**.
2. Trace the red shape.



3. Place your pencil point on the **turn center**. Turn the tracing so that the dot moves along the turn arrow. Stop when the dot is on the tip of the turn arrow.



The traced shape matches the blue shape.
The blue shape is the **turn image** of the red shape.

154

LESSON ACTIVITY

Before Using the Pages

- Review the concept of a turn. This can be done using a pin and a cardboard shape such as a triangle. Place the shape on a surface such as a cork board and fasten it there with a pin at one vertex. This will permit the shape to turn about that vertex. The outline of the shape can be traced with chalk to show the starting position and other positions after turning the shape. The pin may be moved from time to time to obtain different turn centres.

Using the Pages

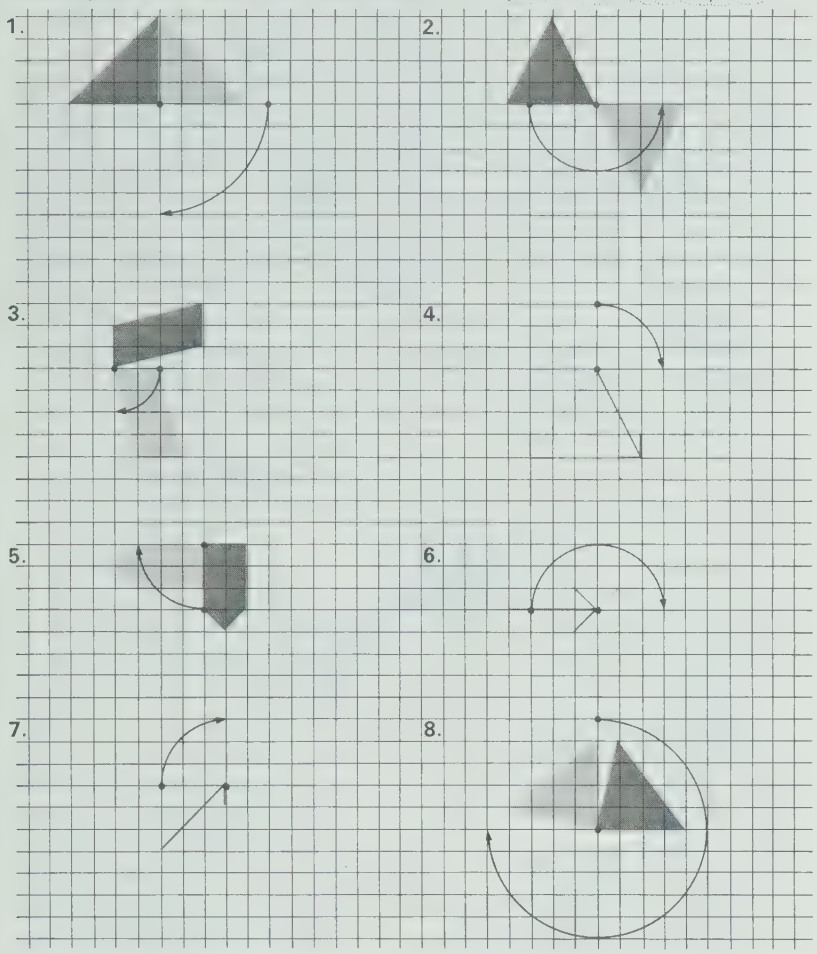
- Most students have played on swings at one time or another and have experienced the concept of a turn. They can relate a small turn to a "gentle" swing and a large turn to "swinging high". Emphasize that in a turn there is no slide motion (as on a playground slide, for example) and no flip motion. Have students suggest other examples of turn motions, such as the hands of a clock, the pendulum o clock, and turning a door knob.

Working Together: Discuss Ex. 1 with the students before th begin on their own. Introduce the term *turn centre* and *tu arrow*. The turn arrow indicates the direction of the t and the amount of turning. The turn centre is similar to point at which the chain is attached to the bar at the top the swing. Ensure that the students understand which shows the turn centre and which dot shows the end of turn arrow. Give each student a sheet of tracing paper a have the children complete Ex. 1-3. A sharp pencil is b for holding the turn centre in place as the paper is turne Emphasize that the turn ends when the dot (marked at t end of the turn arrow) reaches the tip of the turn arro Introduce the term *turn image* as described at the bottom page 154. Ask questions such as,
"Is the blue shape congruent to the red shape?"
"Would the blue shape still be the turn image of the r shape if the turn were longer? shorter?"

Exercises

Copy these pictures on graph paper. Use tracing paper to test whether the blue shape is the turn image of the red shape for the given turn center and turn arrow.

To draw the turn arrow, draw both ends of the arrow carefully, then sketch the curved part.



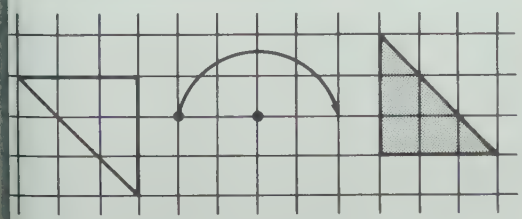
1. yes 2. yes 3. yes 4. no
5. yes 6. yes 7. yes 8. yes

155

rcises: Students usually experience more difficulty with turns than with slides or flips. You may need to help small groups of students to ensure that their copies are correct and that they understand the procedure of tracing and turning. Have them write "Yes" for shapes that are turn images and "No" for shapes that are not.

essment

y the pictures on graph paper. Use tracing paper to test ther the gray shape is the turn image of the white shape for given turn centre and turn arrow.



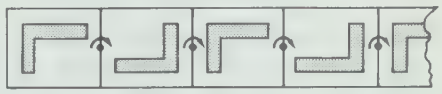
yes

RELATED ACTIVITIES

- Have students use a cardboard stencil of a letter of the alphabet, for example, to create designs based on turns such as a half turn (180°). A strip of paper can be marked with turn centres and turn arrows to guide the students.

stencil

strip pattern



- Have students identify those exercises on page 155 that show flip images as well as turn images (Ex. 1, 6). It will be necessary to judge where the flip line would be for each.

Pages 156-157

OBJECTIVE

Demonstrate competence in identifying images for slides, flips, and turns

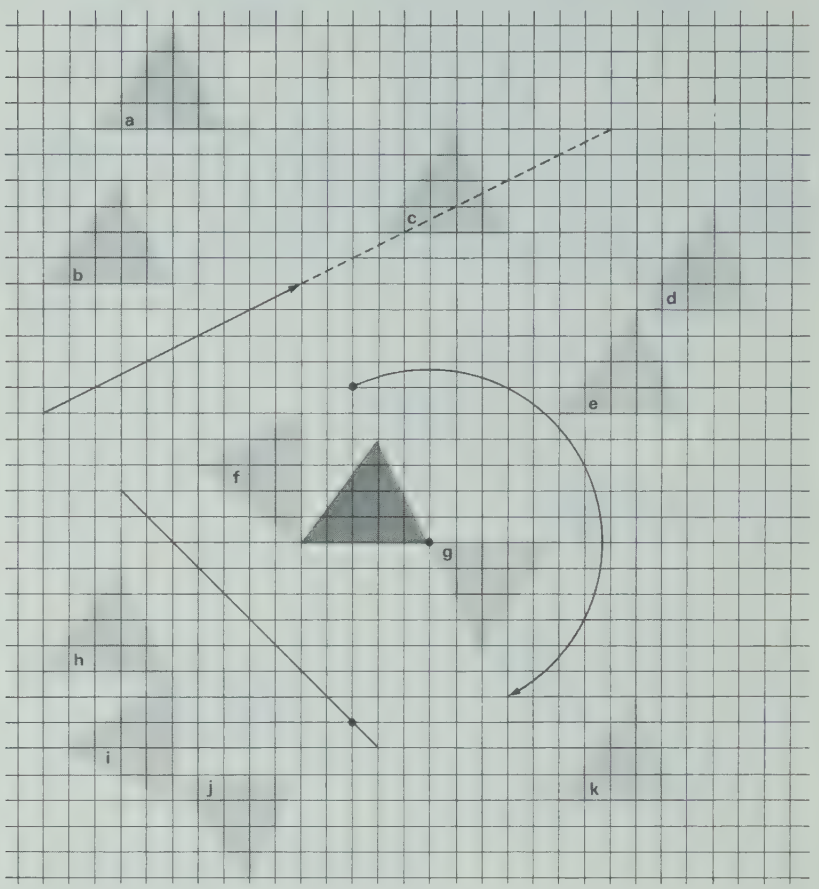
Materials

tracing paper and a sharp pencil for each student

Practice

Use tracing paper to help you find

1. the slide image of the red shape for the given slide arrow. e
2. the flip image of the red shape for the given flip line. i
3. the turn image of the red shape for the given turn center and turn arrow. g



156

LESSON ACTIVITY

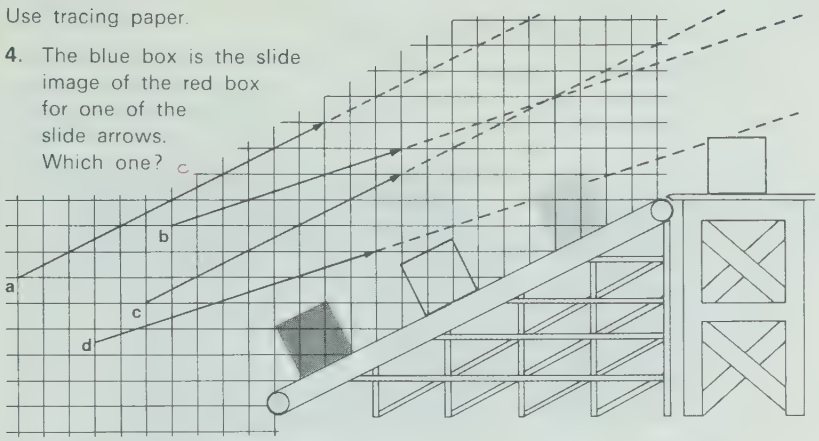
Using the Pages

- Begin with a discussion of the drawings on page 156. Have the students point in turn to the slide arrow, the flip line, and the turn arrow. Have them trace the slide arrow and its extension with their fingers. Ask questions such as,
  "Do you think shape "a" is the slide image of the red shape for this slide arrow?"
  Have them give a reason for their answer. Ask similar questions regarding the flip line and the turn arrow. Questions like these will encourage students to try the most obvious shapes first for each motion. Review that an object and its image under a slide, a flip, or a turn are always congruent.

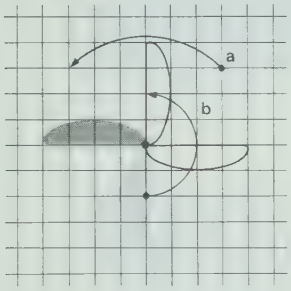
  Help those students who are not sure what must be traced in Ex. 1-6. For Ex. 7-9, the sentence should name the object which moves in a certain way; for example, in Ex. 7, "I turn a handle or a knob."

Use tracing paper.

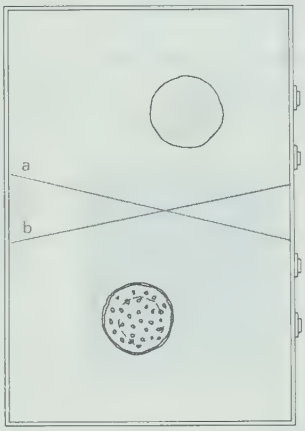
4. The blue box is the slide image of the red box for one of the slide arrows. Which one? c



5. The blue propeller blade is the turn image of the red blade for one of the turn arrows. Which one? a



6. The cooked pancake is the flip image of the uncooked pancake for one of the lines on the grill. Which one? a



Write a sentence to answer each of these questions.

7. Do you slide, flip, or turn something to get a drink of water?

8. Do you slide, flip, or turn something to open a window?

9. Do you slide, flip, or turn something to play your favorite game?

Answers will vary for Ex 7-9

RELATED ACTIVITIES

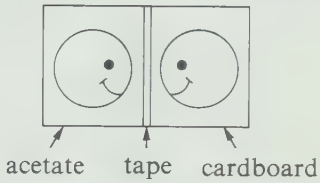
• Students may be interested in helping to compile a list of examples of slides, flips, and turns, similar to those in Ex. 7-9.

What do you turn
1. to open a door?
2. to get a drink of water?
3. to wind a clock?

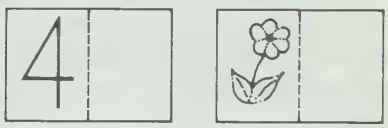
What do you slide

What do you flip

• Prepare a set of flip cards similar to the following. Students must decide before flipping the cards whether the shape on the right is the image of the shape on the left. One shape is drawn on acetate, the other on cardboard, and they are joined to form a flip line.



• Prepare flip cards by folding sheets of paper in half. Draw shapes on one half. Have students use a transparent plexiglass mirror on the fold line to help them draw the flip images on the other half.



Pages 158-159

LESSON OUTCOME

Identify lines of symmetry using flip lines

Materials

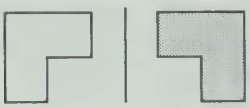
graph paper (copies of page T367), tracing paper, a straight edge, and a sharp pencil for each student

Prerequisite Skills

Identify one figure as the flip image of another figure in a given flip line

Checking Prerequisite Skills

Tell whether the gray shape is the flip image of the white shape for the given flip line.

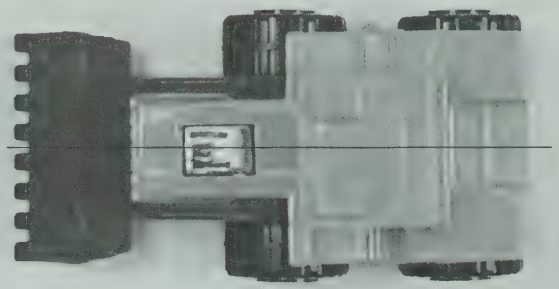
1.  yes
2. no
3. yes

Background

On pages 152 and 153, a shape and its image were distinct because the flip line was not part of the shape. On these pages, students examine a shape itself for line symmetry, and the flip line is on the shape and is the line of symmetry.

Flip Lines and Lines of Symmetry

This picture shows line symmetry. The line of symmetry drawn on the picture shows two parts that are alike.

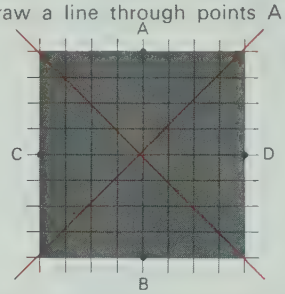


Trace the part of the tractor that is on one side of the line of symmetry. Flip your tracing using the line of symmetry as a flip line.

The tracing will match the other part of the tractor. A line of symmetry is the flip line for the two matching parts.

Working Together

Copy this shape on graph paper and draw a line through points A and B.



Draw a line through points C and D.

3. Use a tracing and line CD as a flip line. Is line CD a line of symmetry? yes

1. Use tracing paper and trace the shape on one side of line AB. Flip the tracing using line AB as the flip line.
2. If your tracing matches the part on the other side of line AB, the shape has line symmetry. Does it? yes
4. Are there other lines of symmetry? yes
5. How many can you find? 2 more

158

LESSON ACTIVITY

Before Using the Pages

- Briefly review that a line of symmetry separates a picture into two parts that are alike. This can be done by having the students turn to page 74 of their books and recall their previous discussion of line symmetry for the photograph (see pages T80 and T81). Have the students name objects in the room that have line symmetry and identify the lines of symmetry. Also, have them name objects that do not have line symmetry.

Using the Pages

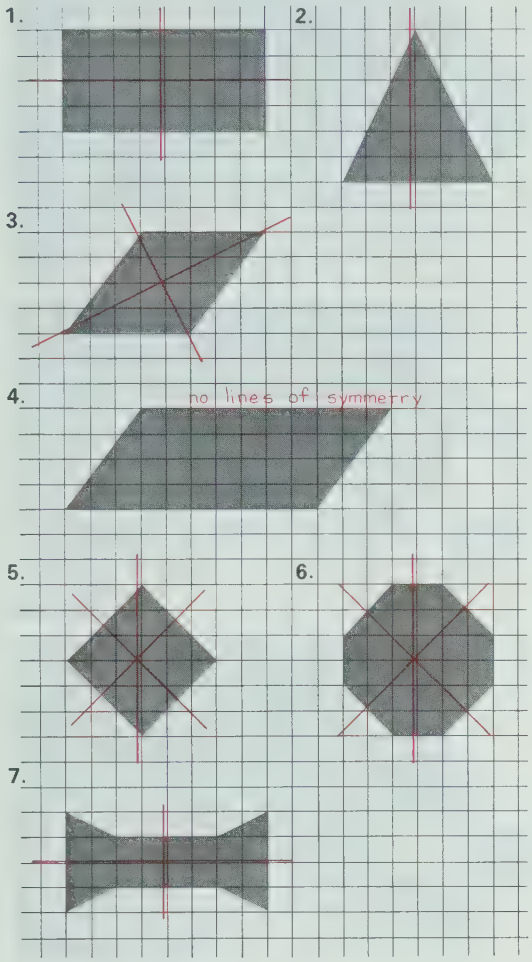
- Ask the students what object is shown in the photograph and what the black line represents. Develop that the line is a line of symmetry because it separates the picture of the tractor into two parts that are alike. Each part on one side of the line has a matching part on the other side of the line. Students may point to matching parts using two fingers. Ask how a line of symmetry is similar to a flip line. The students will likely suggest that one half the picture co be flipped using the line of symmetry as a flip line, and two parts would match.

  Read the statements beneath the photograph, and t distribute tracing paper for the students to attempt procedure described. You might suggest that one edge the tracing paper can represent the flip line, illustrating if necessary. When the students have finished, empha that each part is the flip image of the other part, and the of symmetry is the flip line. This shape has one line symmetry. Ask whether a shape can have more than line of symmetry.

Working Together: These exercises develop the relations between lines of symmetry and flip lines for a geome shape. In other words, if one half of a shape is the image of the other half, the flip line is a line of symmetr the shape. Since the flip line is part of the shape, students may find it convenient to use an edge of t tracing paper as the flip line each time, and simply w around the border of their tracing paper, provided it

Exercises

Copy these shapes on graph paper. Use tracings to find all the lines of symmetry. Show the lines of symmetry for each shape.



Add or subtract.

1. 7377 − 4126 3251
2. 3561 + 5123 8684
3. 1282 + 523 1805
4. 5724 + 2718 8442
5. 2863 − 2327 536
6. 1385 + 1459 2844
7. 8251 − 3891 4360
8. 2327 − 749 1578
9. 7423 − 4536 2887
10. 3614 + 2552 6166
11. 6147 − 1748 4399
12. 3948 + 367 4315
13. 4736 + 3569 8305
14. 5030 − 3981 1049
15. 6001 − 5069 932
16. 3985 + 3767 7752
17. 7000 − 3486 3514
18. 382 + 1287 + 276 1945
19. 8073 − 1279 6794
20. \$2420 + \$466 \$2886
21. \$5830 − \$3032 \$2798
22. \$369 + \$187 + \$548 \$1104
23. \$4152 − \$2985 \$1167
24. \$52.64 + \$34.61 \$87.25
25. \$39.27 − \$7.65 \$31.62
26. \$27.91 + \$22.97 \$50.88
27. \$39.75 + \$15.85 \$55.60
28. \$6.00 − \$4.13 \$1.87
29. \$625 + \$896 \$1521

KEEPING SHARP

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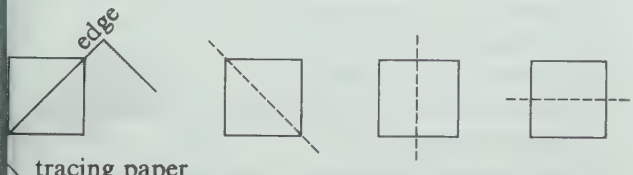
straight edges as shown. Ex. 4 and 5 are important in that the students will encounter a total of four lines of symmetry for the square, in answer to the question suggested at the end of the preceding paragraph.

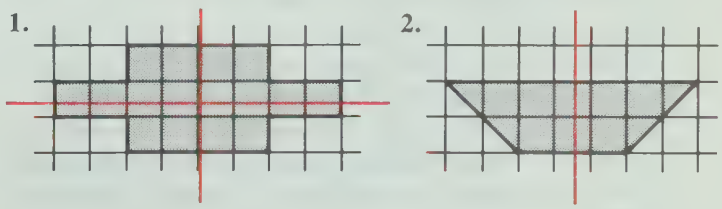


rcises: Caution the students to copy these shapes carefully since the shape determines the symmetry. You may wish to have the students identify each shape by name (rectangle, triangle, quadrilateral, square, octagon). Have them write the number of lines of symmetry they were able to find for each. When they have finished their work, discuss that the diagonals (the lines joining opposite corners) are lines of symmetry in a square (Ex. 5) but not in the quadrilateral in Ex. 4. Note that the shape in Ex. 4 has no lines of symmetry.

Keeping Sharp: These exercises review skills in addition and subtraction. Ex. 20-29 involve amounts of money with dollars and with dollars-and-cents notation. Review the regrouping procedure with any students having difficulty.

Assessment

Copy these shapes on graph paper. Use tracings to find all the lines of symmetry. Show the lines of symmetry for each shape.



RELATED ACTIVITIES

- Have students cut the shapes from copies of pages T353-T356. Have them fold each shape to test for lines of symmetry. Have them draw lines along the folds to show the lines of symmetry. The shapes may be displayed in groups according to the number of lines of symmetry.
- Students may fold and cut sheets of paper as described in *Related Activities* on page T81 to obtain shapes having one line of symmetry. They may create shapes having two lines of symmetry by folding a sheet twice, once horizontally and then vertically, and then cutting around the folds. These may be placed with the display from the preceding activity.
- Have students use transparent plexiglass mirrors on the shapes on pages 158 and 159 to find the lines of symmetry.

Pages 160-161

OBJECTIVE

Demonstrate the ability to identify lines of symmetry in shapes

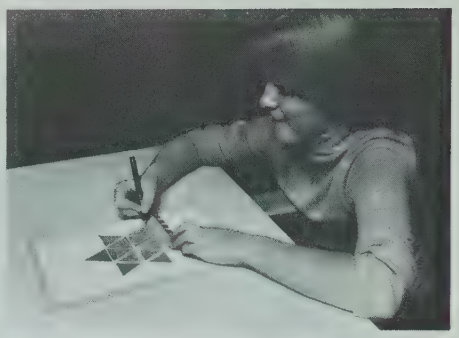
Materials

tracing paper, a straight edge, and a sharp pencil for each student

Checking for Symmetry

Paula uses tracing paper to check for line symmetry.

First, she traces a shape.



Then she folds her tracing and tries to match one part of the shape with the other part.

If the parts of the shape on each fold match, the shape has line symmetry. The fold line is the line of symmetry.

160

LESSON ACTIVITY

Using the Pages

- Begin with a discussion of line symmetry in the environment, for example, in natural shapes such as the honeycomb or the shape of a tree, and in man-made designs similar to those on these pages.

  Lead the students through a discussion of the steps on page 160. Point out that folding the shape along a line of symmetry is similar to flipping one half the shape along a flip line. Emphasize that the two parts must match for the fold line to be a line of symmetry. Discuss the need for accuracy in tracing the shape. Some students may be able to identify the shape Paula traced as Canada's centennial symbol.

Exercises: Students may be interested in knowing that shapes are logos of the following.

1. Halifax Transit Corporation
2. Government of Ontario
3. Ontario Film Laboratories
4. Pan American Games Society
5. Canadian Film Institute
6. International Airport Consultants of Montreal Ltd.
7. Ville de Montreal
8. The Canadian Conference of the Arts
9. The Canadian National Institute for the Blind Caterp Services

Point out that some shapes have more than one line symmetry and thus the shapes must be traced as accurat as possible, using a straight edge for assistance as neede

Exercises

Trace these shapes. Check for line symmetry by folding your tracings.

161

RELATED ACTIVITIES

- You may wish to show some of the students' tracings for these exercises in the display of symmetric shapes suggested in *Related Activities* on page T 171.
- You may wish to have students examine various road signs for lines of symmetry. These signs are usually found on provincial road maps.
- Some students may be interested in creating their own designs similar to those on the page, for one or more lines of symmetry.
- Have students search magazines and newspapers for logos that show symmetry. These may be added to the display.
- Students may use a transparent plexiglass mirror to investigate the line symmetry of the shapes on page 161.

LESSON OUTCOME

Match ordered pairs with regions on a map

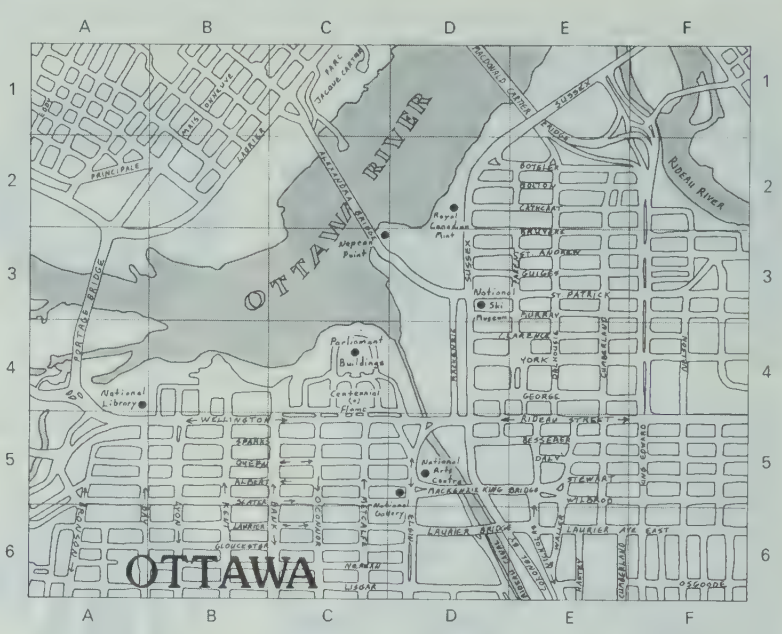
Materials

maps of different cities (optional)

Vocabulary

region

Places on a Map



The map shows part of Ottawa, our nation's capital. The numbers and letters along the edges help locate places on the map.

The letter for the Parliament Buildings is C. The number is 4. The Parliament Buildings are in region (C, 4).

Working Together

Give the letter for

1. Bank Street. C
2. the Royal Canadian Mint. D

Name the region for

5. the Royal Canadian Mint. (D,2)
6. where Bronson Avenue meets Laurier Avenue. (A,6)

Always give the letter first.

Give the number for

3. Sparks Street. 5
4. the Royal Canadian Mint. 2

Name

7. a bridge in region (A, 3). Portage Bridge
8. two streets that meet in region (E, 5). Answers will vary; for example, Cumberland St. and Rideau St.

162

LESSON ACTIVITY

Using the Pages

- Have students name the city represented in the map. Some students may wish to comment on their visit to the capital city of Canada or to other cities. Have them suggest ways in which maps are helpful. Have them name various streets to familiarize them with the map. Some students may already be familiar with the procedure of using an ordered pair to locate a region. If so, have them describe the procedure of locating the Parliament Buildings by an ordered pair. Then confirm (or modify) their suggestions by reading the statements beneath the map. For example, if the ordered pair suggested is (4, C), discuss that, by convention, the letter is always named first and the number second. This is important in preparing students for naming points on a grid (pages 164-165), as the first number named will correspond to the number of units counted *over*. Point out how the ordered pair is written using parentheses and a comma (C, 4). Have the students count the regions on the map.

Working Together: These exercises focus on four skills: na the letter for a place; name the number for a place; name t ordered pair for a place; name the place for an ordered pa Draw the students' attention to the reminder in t "thought cloud". A discussion of the answers can rev that Bank Street (Ex. 1) runs through two of the six regio identified by the letter C, and that the Royal Canadian M (Ex. 4) is located in just one of the six regions identified the number 2. This helps to point out the need for namin letter and a number to define positions (Ex. 5-8). Note t Ex. 8 has more than one answer.

Exercises: One region will be named for Ex. 1-10. More th one region will be named in Ex. 11-13. If you wis provide the students with maps of other cities for Ex. 2

Keeping Sharp: These exercises review basic multiplicati and division facts. Encourage speed and accuracy having students write answers without first copying t exercises. Have them prepare their pages first by numb ing the exercises in the same arrangement as in the text

Exercises

Name the region for

1. the National Arts Centre (D, 5)
2. Nepean Point. (C, 3)
3. where Metcalfe Street meets Sparks Street. (C, 5)
4. where Sussex Drive meets York Street. (D, 4)
5. the National Library. (A, 4)
6. the National Gallery. (D, 5)
7. the National Ski Museum. (D, 3)
8. the Centennial Flame. (C, 4)
9. where the Rideau Canal meets the Ottawa River. (D, 4)
10. where Rideau Street meets Wellington Street. (D, 5)

Name the regions for

11. Nepean Street (B, 6), (C, 6), (D, 6)
12. Bay Street. (A, 5), (A, 6)
13. the Rideau Canal. (D, 4), (D, 5), (D, 6), (E, 6)
14. the Laurier Bridge. (D, 6)

Name

15. a street in region (D, 5).
16. two streets in region (B, 5).
17. a bridge in region (D, 1).
18. a curved road in region (D, 2). Sussex Drive
19. two streets that meet in region (A, 6).
20. the number of city blocks that are part of region (B, 6). 15

Use the map on page 162 or some other map.

21. Make up a problem and give it to a friend.

Multiply or divide.

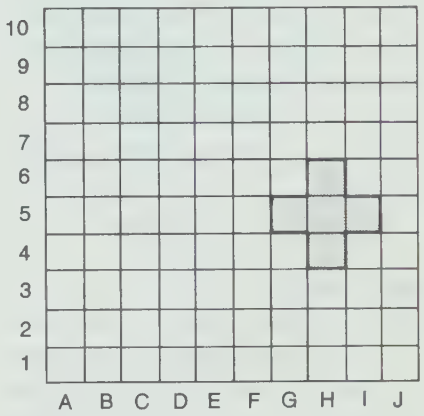
1. 4×2 8	2. $3\overline{)18}$ 6	3. $2\overline{)4}$ 2	4. 3×2 6	5. $2\overline{)8}$ 4	6. $8\overline{)32}$ 4
7. $3\overline{)9}$ 3	8. 4×6 24	9. 2×3 6	10. $6\overline{)6}$ 1	11. 6×9 54	12. 3×5 15
13. 1×5 5	14. 6×2 12	15. $1\overline{)4}$ 4	16. 8×7 56	17. $4\overline{)20}$ 5	18. 5×7 35
19. $6\overline{)48}$ 8	20. $5\overline{)10}$ 2	21. $6\overline{)30}$ 5	22. 2×9 18	23. 4×0 0	24. $8\overline{)16}$ 2
25. 1×2 2	26. $6\overline{)36}$ 6	27. 4×4 16	28. $9\overline{)9}$ 1	29. $2\overline{)12}$ 6	30. 2×7 14
31. $4\overline{)12}$ 3	32. 9×4 36	33. 5×6 30	34. 8×3 24	35. 2×5 10	
36. $6\overline{)42}$ 7	37. 8×6 48	38. 6×8 48	39. $9\overline{)54}$ 6	40. $3\overline{)24}$ 8	
41. $8\overline{)72}$ 9	42. $1\overline{)8}$ 8	43. 2×0 0	44. $3\overline{)12}$ 4	45. 5×5 25	
46. 9×8 72	47. 0×5 0	48. $9\overline{)81}$ 9	49. 7×7 49	50. $7\overline{)63}$ 9	

KEEPING SHARP

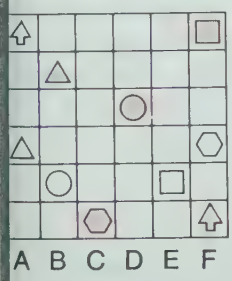
15. Answers will vary; for example, Besserer St.
16. Answers will vary; for example, Sparks St and Queen St.
17. Macdonald Cartier Bridge
19. Answers will vary; for example, Laurier Ave and Bronson Ave.

RELATED ACTIVITIES

- Some students may wish to draw a map of their own and prepare questions similar to those on the page for other students to answer. A floor plan of the school might be adaptable.
- Students may play a game in pairs using two ten-by-ten grids (cut from copies of page T365). Each grid is marked with the letters A to J and the numbers 1 to 10 for identifying regions. Each player draws one shape to occupy exactly five regions. Each player, in turn, names a region to guess whether the opponent's shape occupies that region. If correct, that player has another turn. If not, it is the other player's turn. The first player to guess all five regions for the opponent's shape wins the game. Players should keep a record of their guesses for an opponent's shape by making appropriate marks on their own grids.



ssessment



me the region for

2. (A, 6) 2. (C, 1)

aw the shape shown in the gion named by

(E, 2) 4. (B, 5)

Pages 164-165

LESSON OUTCOME

Match ordered pairs with points on a grid

Materials

copies of page T367 and a straight edge for each student

Vocabulary

grid, number pair

Prerequisite Skills

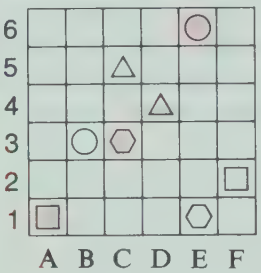
Match ordered pairs with regions on a grid

Checking Prerequisite Skills

Name the region for

1. □
2. △

1. (A,1)
2. (D,4)

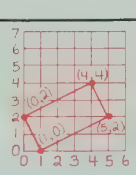


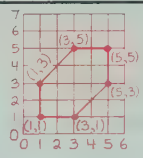
Draw the shape shown in the region named by

3. (B, 3) ○
4. (E, 6)

Background

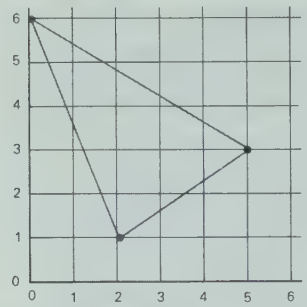
In the previous lesson, students used an ordered pair consisting of a letter and a number to identify a region. This lesson differs in that an ordered pair of numbers, for example, (5, 3), names a point rather than a region.

Page 165 Exercise 9. 

10. 

Positions on a Grid

Number pairs can name the points on a grid.



One vertex of the triangle is shown in black. To name it, count over 5 and up 3. (5,3) names the black vertex.

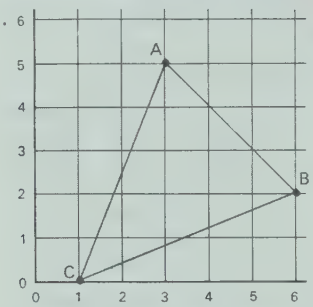
To name a point on a grid with a number pair, count *over* for the first number and count *up* for the second number.

The other vertices of the triangle are named with the number pairs (2,1) and (0,6).

Working Together

Count over, then up to name each vertex of this triangle with a number pair.

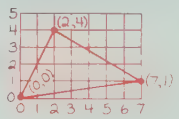
A (3,5), B (6,2), C (1,0)

1. 

Draw a grid. Number the lines. Connect the points that are named by these number pairs.

2. (2, 4) 3. (0, 0) 4. (7, 1)
5. What polygon did you draw?

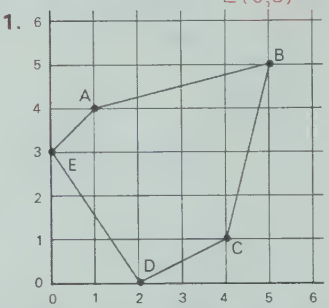
a triangle



Exercises

Write a number pair for each vertex of this pentagon.

A(1,4), B(5,5), C(4,1), D(2,0), E(0,3)

1. 

Draw a grid. Number the lines. Connect the points that are named by these number pairs.

2. (0, 2) 3. (2, 3) 4. (6, 5)
5. Are the points all in line or do they form a triangle?

The points are all in line.

LESSON ACTIVITY

Using the Pages

- Lead the students in a discussion of the diagram at the top of page 164. Ask questions such as,
  "What kind of polygon is shown?"
  "How many sides has it?" "How many vertices has it?"
  "How many vertices are shown in black?"

  Discuss that each vertex of the triangle is a point where two of the grid lines cross. Since the grid lines are numbered, we can use pairs of numbers to name points where the lines cross. Read the statements that describe how to name the black vertex. Establish the lower left corner of the grid as the "starting point" for counting. Have the students place one finger on the starting point and then trace along the grid lines as they count over 5 and up 3.

  Read the statements that establish the order of counting over first and then up. Write the number pair (3, 5) on the board and ask if this also names the black vertex. Have students trace the path to locate point (3, 5) on the grid.

Emphasize the need for remembering the order of counti over and then up. Draw attention to the term *number pa* Have students name the number pairs for the remaining t vertices and check their answers with those shown benea the grid. Then have the students follow instructions simil to the following and answer questions orally.

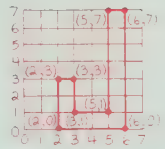
Start at the starting point.
Count over 2 and up 4.
What number pair names this point?

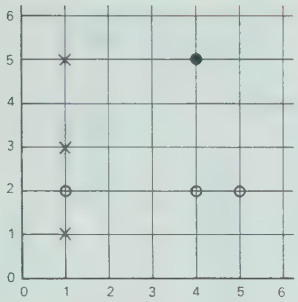
Include such examples as counting over 5 and up 0, ov 0 and up 3, and finally, have them identify the number p that names the starting point by having them count over and up 0.

Working Together: For Ex. 1, have the students write t capital letter for a vertex and the number pair beside it, as A (3, 5). You may need to remind them to show t parentheses and the comma for a number pair.

Provide each student with a copy of the graph paper page T367 and have them label a seven-by-seven region f Ex. 2-4. Use other exercises similar to these as needed.

For this grid,





(1,2), (4,2), (5,2)
The second number in each pair is 2.

6. write number pairs for the points marked with O. How are these pairs alike?

7. write number pairs for the points marked with X. How are these pairs alike?

(1,1), (1,3), (1,5) The first number in each pair is 1.

In the above grid,

8. four of the seven points are vertices of a square. Write the number pairs.

(1,5), (4,5), (4,2), (1,2)

Draw a grid. Number the lines. Then draw from point to point to make a shape.

9. Draw (4,4) → (5,2) → (1,0) → (0,2) → (4,4)

10. Draw (1,1) → (1,3) → (3,5) → (5,5) → (5,3) → (3,1) → (1,1)

11. Draw (6,0) → (6,7) → (5,7) → (5,1) → (3,1) → (3,3) → (2,3) → (2,0) → (6,0)

12. What polygons did you draw?

(9) quadrilateral or rectangle (10) hexagon (11) octagon

Multiply.

1. 20 × 3 = 60	2. 400 × 2 = 800	3. 20 × 6 = 120
4. 40 × 5 = 200	5. 70 × 3 = 210	6. 400 × 7 = 2800
7. 60 × 6 = 360	8. 900 × 3 = 2700	9. 80 × 5 = 400
10. 500 × 9 = 4500	11. 70 × 8 = 560	12. 90 × 7 = 630

Divide.

13. 4)120 = 30	14. 2)40 = 20	15. 3)150 = 50
16. 5)100 = 20	17. 6)240 = 40	18. 3)90 = 30
19. 4)280 = 70	20. 5)250 = 50	21. 9)810 = 90
22. 4)80 = 20	23. 6)540 = 90	24. 7)350 = 50
25. 8)480 = 60	26. 5)400 = 80	27. 9)360 = 40
28. 7)420 = 60	29. 2)60 = 30	30. 8)40 = 5

Multiply.

31. 31 × 3 = 93	32. 12 × 4 = 48	33. 36 × 2 = 72
34. 38 × 6 = 228	35. 57 × 5 = 285	36. 85 × 3 = 255
37. 513 × 8 = 4104	38. 360 × 5 = 1800	39. 602 × 9 = 5418
40. $145 × 4 = $580	41. $3.87 × 7 = $27.09	

KEEPING SHARP

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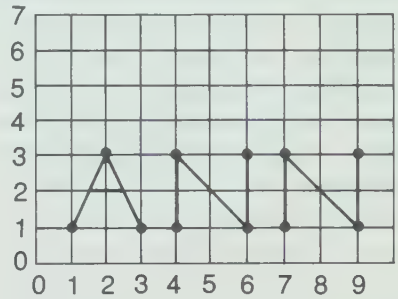
RELATED ACTIVITIES

• Adapt the second activity described in *Related Activites* on page T 175 for points on a grid. Each player numbers the lines on a ten-by-ten grid (use copies of page T 365) and marks five points to suggest an X on the grid.

• Certain letters of the alphabet may be drawn on a grid to suggest points for students to identify by number pairs.



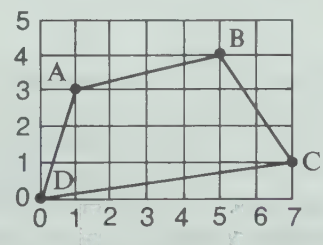
ercises: For Ex. 9-11, it is essential that the students join the points in the specified order to obtain the required shapes. You may wish to expand the instructions that precede Ex. 9 before the students begin.

When the students have finished, it is important to discuss the exercises with them to draw out various concepts. For example, in Ex. 6, the three points are in the same horizontal line and their number pairs show the same second number. Similarly, for Ex. 7, the points are in the same vertical line and their number pairs show the same first number. The students may wish to test other sets of points to see whether this pattern is always true.

eping Sharp: Ex. 1-12 review extensions of basic multiplication facts for multiples of ten to 90 and multiples of one hundred to 900. Ex. 13-30 review similar extensions of basic division facts, thereby reinforcing corresponding concepts for inverse operations. Ex. 31-41 review the standard algorithm for multiplication with a one-digit multiplier. These exercises are to be completed in writing. However, at this time or at a later time, many students would benefit from giving oral answers for Ex. 1-30. Students may work in pairs giving oral answers for alternate exercises or alternate rows of exercises.

Assessment

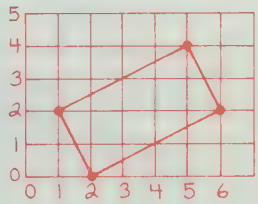
Write a number pair for each vertex of this quadrilateral.

1. 

1. A (1,3)
B (5,4)
C (7,1)
D (0,0)

Draw from point to point to make a shape.

2. Draw (1,2) → (5,4) → (6,2) → (2,0) → (1,2)

2. 

3. What polygon did you draw? rectangle

Page 166

LESSON OUTCOME

Draw a pictograph to display information

Materials

overhead projector (optional)

Vocabulary

pictograph

RELATED ACTIVITIES

- If students worked in groups for Ex. 5, have each group prepare a set of questions regarding their graph and display the questions beneath the graph. Have other students answer the questions. This will provide practice in interpreting information shown in a graph.
- Have students search magazines and newspapers for examples of pictographs. These may be displayed and interpreted.

WHERE CHILDREN LIVE	
Apartments	☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺
Houses	☺ ☺ ☺ ☺ ☺
Townhouses	☺ ☺
☺ stands for 2 children	

Drawing Pictographs

The students in Room 4B talked about where they were born. They recorded this information.

Place of Birth	Number of Students
Our town	8
Elsewhere in our province	12
In another province	4
In another country	6

Then they drew this **pictograph**.

BIRTHPLACES FOR OUR CLASS	
Our town	☺ ☺ ☺ ☺
Our province	☺ ☺ ☺ ☺ ☺ ☺
Another province	☺ ☺
Another country	☺ ☺ ☺
☺ stands for 2 students	

Exercises

Draw pictographs for each of these.

1. the birthplaces for your class Answers will vary.
2. 9 children with brown hair, 15 with black hair, and 6 with hair of some other color
3. the color of hair in your class
4. the favorite ways to travel for your class

HAIR COLOR FOR A CLASS	
Brown	☺ ☺ ☺ ☺ ½
Black	☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺ ½
Other	☺ ☺ ☺
☺ stands for 2 students.	

Think of another kind of information that you could show on a pictograph. Answers will vary for Ex. 3-5.

5. Collect the information and draw the pictograph.

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LESSON ACTIVITY

Using the Page

- Discuss the chart and the pictograph shown to introduce this topic to the students. Draw attention to the term *pictograph* and discuss the name in relation to the pictures representing students on the graph. (Each picture of a student represents two students.)

Exercises: Complete Ex. 1 with the students. Have each student make an individual chart on paper as it is developed on the board during a survey of the class. Before the students draw their graphs, point out the headings in the pictograph shown. Emphasize the importance of showing a title, separate headings for each category, and a "key" to show the picture and the number each represents. When the students have drawn their graphs, show a completed graph on the board or on an overhead transparency for them to check their work.

It will be necessary to collect the information for Ex. and 4 before assigning these exercises. The survey can conducted by you with the students raising a hand for t appropriate category; or, each student may go to the boar in turn, and draw a tally for the appropriate category. Ha students help to decide what titles and categories should included. Notice that the necessary data is provided for E 2, and this can be of help in Ex. 3. Ask whether ea picture should stand for 2 or for a different number children for Ex. 2.

If you wish, have students work in small groups for E 5, preparing a large graph that can be displayed.

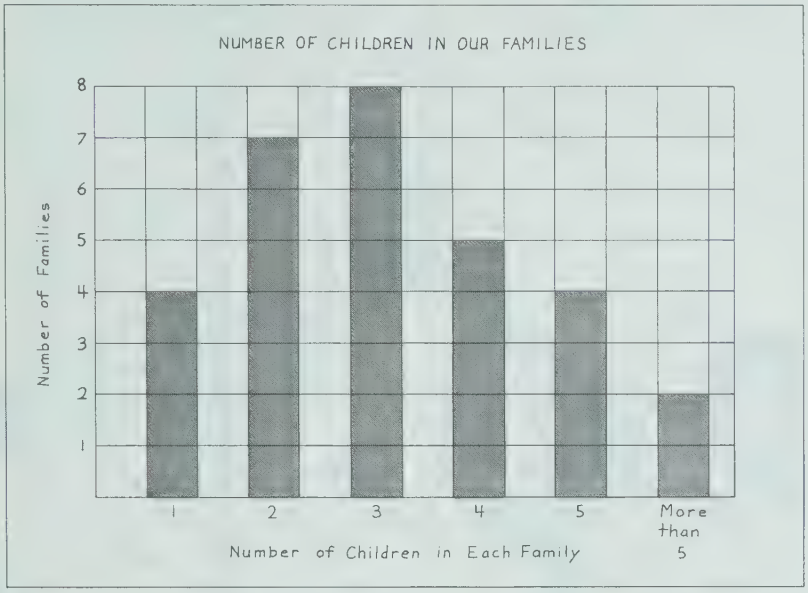
Assessment

Draw a pictograph for this information.

1. 16 children live in apartments, 10 in houses, and 4 in tov houses. See answer under "Related Activities

Drawing Bar Graphs

The students drew this **bar graph** to show the number of children in their families.



Exercises

Draw bar graphs for each of these.

1. the number of children in the families for your class
2. the number of children in your class who were born in winter, in spring, in summer, in the fall
3. the number of shoes in your classroom with 0 eyelets, 2 eyelets, 4 eyelets, 6 eyelets, and so on
4. the favorite ways to travel for your class

Think of another kind of information that you could show on a bar graph.

5. Collect the information and draw the bar graph.

Answers will vary for Ex. 1-5.

LESSON OUTCOME

Draw a bar graph to display information

Materials

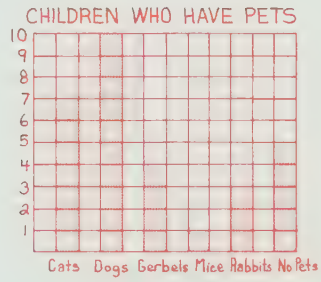
copies of page T 367 and a ruler for each student

Vocabulary

bar graph

RELATED ACTIVITIES

- Samples of bar graphs may be cut from newspapers and magazines and added to the display suggested in the previous lesson.
- Prepare a list of suitable topics for graphing. Some examples are: favorite TV programs; number of books read in one month; number of letters in the words of a given paragraph. Have each student select one of the topics, collect and graph the information, and prepare a few questions regarding the graph. The graphs may be given to other students for practice in interpreting a bar graph.



ESSON ACTIVITY

ing the Page

Have the students study the bar graph for a few moments. Then ask questions similar to the following.

"What name is given to this kind of graph?"
"What is the title of the graph?"
"What do the numbers along the bottom represent?"
"What do the numbers along the side represent?"
"How many families have four children?"
"How many children are in most families?

ercises: It will be necessary to conduct surveys of the students to obtain the information to be graphed in these exercises. Use one of the methods suggested in the previous lesson. Have students help to decide titles and categories for the graphs. Prepare a large display graph for Ex. 1 as the students prepare their own for the same exercise. Students should assist in writing the headings and drawing the bars for the display graph. Graph paper (copies of page T 367) will facilitate drawing the graphs.

Note that Ex. 4 is the same topic as Ex. 4 on page 166. This will provide an opportunity to discuss which kind of graph — a bar graph or a pictograph — seems more suitable for displaying and interpreting the information. When all the graphs have been completed, discuss the results by asking questions similar to those suggested earlier. This helps to emphasize that it is usually easier to interpret information from a graph than from a chart showing numbers.

Assessment

Draw a bar graph for this information.

1. 7 children have cats as pets, 10 have dogs, 4 have gerbels, 1 has a mouse, 3 have rabbits, and 5 have no pets.

See the answer under "Related Activities".

Pages 168-169

OBJECTIVE

Read a scale to obtain necessary information

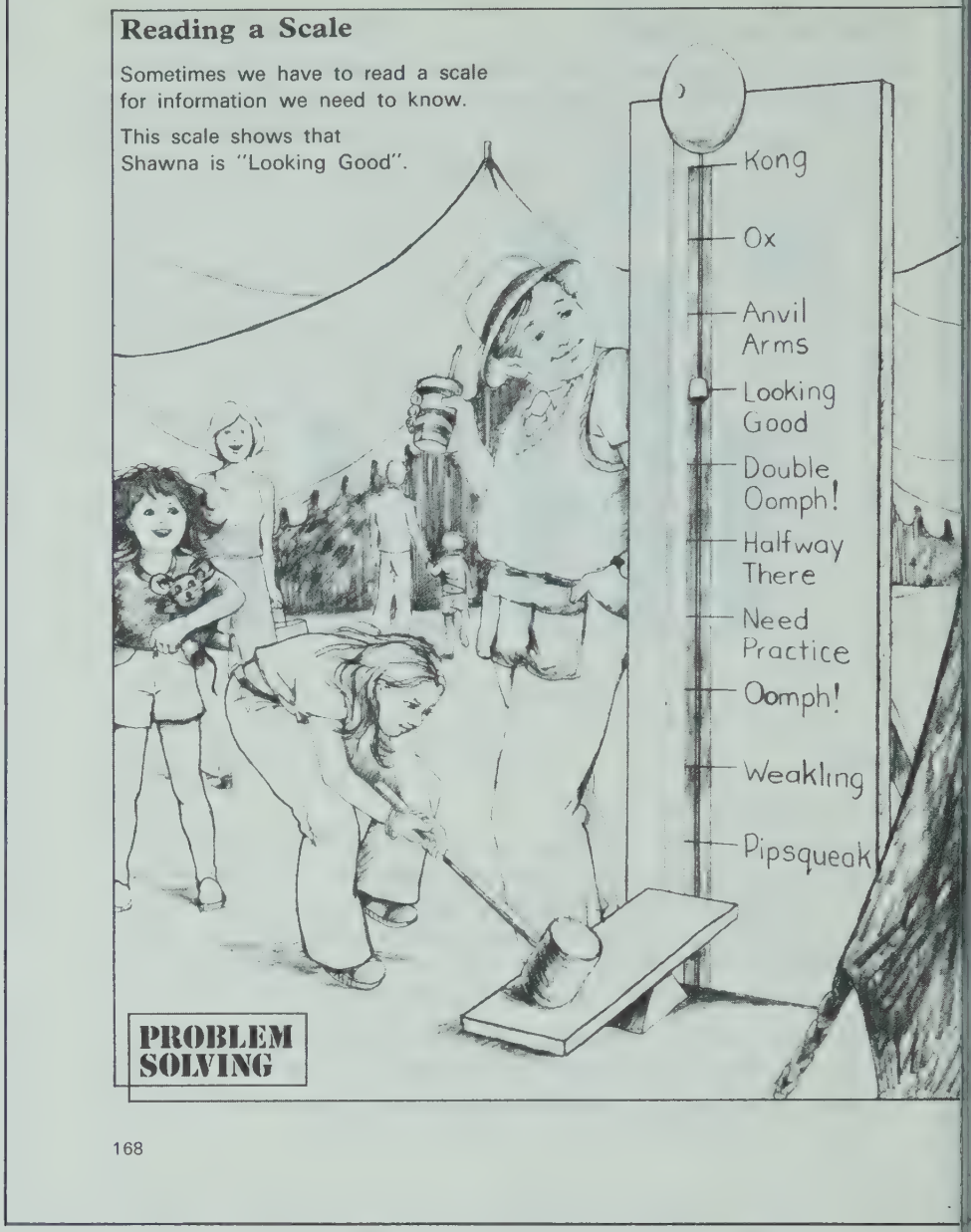
Prerequisite Skills

Complete number patterns

Checking Prerequisite Skills

Copy and complete these patterns.

1. 0, 1, 2, 3, 4, 5
2. 0, 2, 4, 6, 8, 10
3. 0, 20, 40, 60, 80, 100
4. 0, 25, 50, 75, 100
5. 0, 10, 20, 30, 40, 50
6. 0, 5, 10, 15, 20, 25



LESSON ACTIVITY

Using the Pages

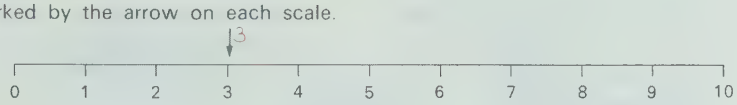
- Most students have visited an exhibition or a fair and will recognize the kind of event portrayed here. Read the statements and relate them to the illustration. Encourage the students to share their experiences of similar events at a fair. They may recall trying a similar feat of strength and may be able to tell what terms were used in the "scale of strength".

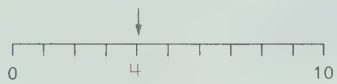
Exercises: Briefly point out that some scales show all the numbers as in Ex. 1, but others show only a few, as in Ex. 3. Emphasize the need to determine the scale before the indicated point can be named. For example, is it a scale that counts by ones? twos? fives? twenties?

The skill of reading a scale involving whole numbers will be extended in the following unit for scales marked in tenths and hundredths.

Exercises

Write the number for the point marked by the arrow on each scale.

1. 

2. 

3.

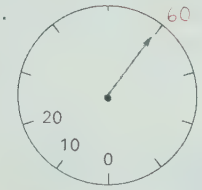
4.

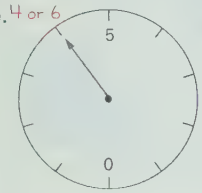
5.

6.

7.

8.

9. 

10. 

11.

12.

13.

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RELATED ACTIVITIES

- Prepare a list of questions similar to the following and have students suggest answers.

What scale do you read to find out
- how cold it is outside?
- how hot the oven should be?
- how heavy the roast is?
- how long your foot is?
- how high the elevator goes?
- how fast the car is moving?
- how much milk the recipe needs?
- how much gas is in the gas tank?

- Students may cut out pictures from magazines and catalogs showing various scales and discuss their uses.

Pages 170-171

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

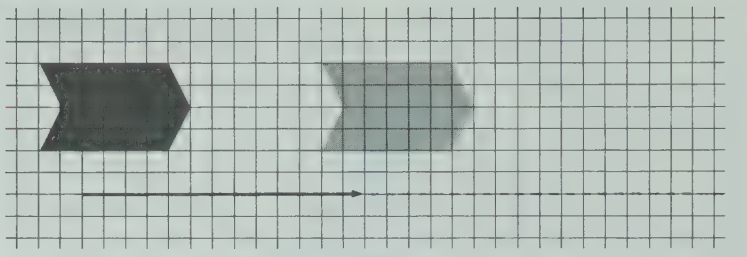
Materials

tracing paper, a straight edge, and copies of page T 367 for each student

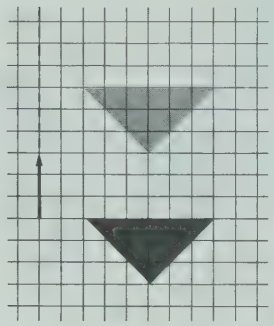
Checking Up

Use tracing paper to test whether the blue shape is the slide image of the red shape for the given slide arrow.

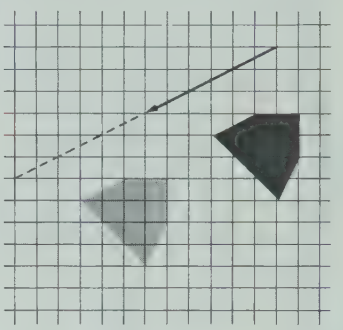
1. yes



2. no

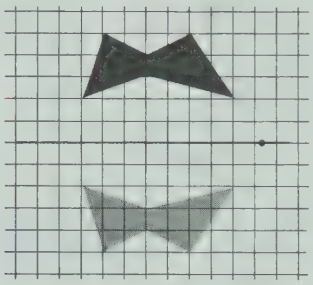


3. yes

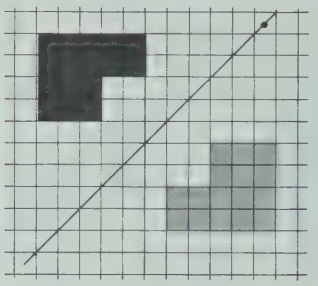


Use tracing paper to test whether the blue shape is the flip image of the red shape for the given flip line.

4. yes



5. no



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Skills	Exercises	Related Pages
Identify one figure as a slide image of another figure for a given slide arrow	1-3	T 162-T 163
Identify one figure as the flip image of another figure in a given flip line	4-5	T 164-T 165
Identify one figure as the turn image of another figure for a given turn center and turn arrow	6-7	T 166-T 167
Identify lines of symmetry using flip lines	8-9	T 170-T 171 T 172-T 173
Match ordered pairs with points on a grid	10-16	T 176-T 177

Comments

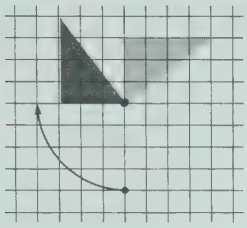
Provide the students with sufficient tracing paper and gra paper to complete these exercises. Have them use their straig edges for tracing line segments. They may write "Yes" "No" to answer Ex. 1-8. For Ex. 8 and 9, some students m trace the whole shape and fold the shape to test for li symmetry. Others may trace one part and flip it for a given li to see if it matches the other part. Both methods are acceptab

It is important to determine whether errors in Ex. 10-15 a caused by counting up for the first number rather than counti over. Also, watch to see whether some students make t mistake of counting *one* as the starting point rather than *zero*

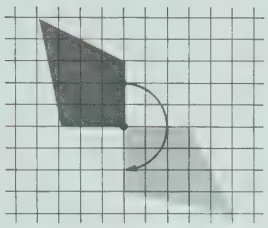
The students should not be rushed in these exercises. Allo them ample time to work carefully at tracing shapes a manipulating the tracings.

Use tracing paper to test whether the blue shape is the turn image of the red shape for the given turn center and turn arrow.

6. yes

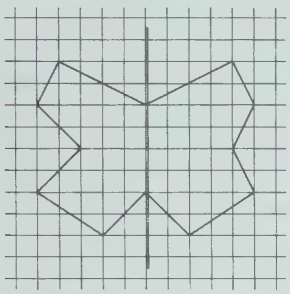


7. no



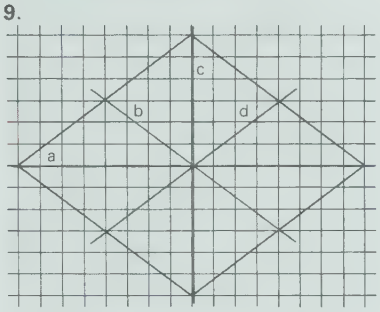
Use tracing paper to test whether the red line is a line of symmetry.

8. no



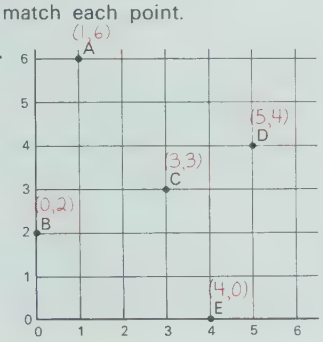
Use tracing paper to find which of the red lines are lines of symmetry.

9. a, c



Write a number pair to match each point.

10.



Draw a grid. Number the lines. Then draw a point to match each number pair.

11. (0, 3) **12.** (5, 2) **13.** (3, 6) **14.** (1, 0)

Answers for Ex. 11-15 are given below.

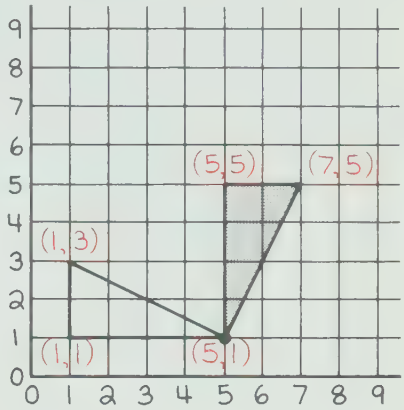
Draw a grid. Number the lines. Then draw from point to point to make a shape.

15. Draw (6, 5) → (6, 0) → (2, 0) → (2, 5) → (6, 5)

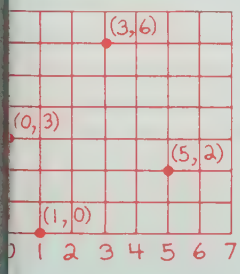
16. What polygon did you draw?
a rectangle

RELATED ACTIVITIES

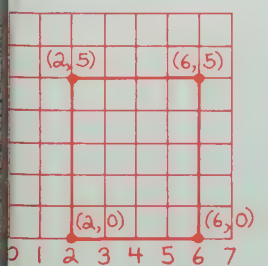
- Samples of wallpaper and fabric may be brought to school. Their patterns may be described in terms of slides, flips, and turns.
- For enrichment, provide students with exercises similar to Ex. 1-7 on copies of page T367 marked for graphing number pairs. Have the students write the ordered pairs for the vertices of a shape and the vertices of the corresponding shape under a slide, flip, or turn.



ercises
,12,13,14



5.



Pages 172-173

OBJECTIVE

Demonstrate competence in addition, subtraction, multiplication, and division; solve related word problems

Checking Skills

Add.

1. 236 + 26 = 262	2. 3582 + 154 = 3736	3. 915 + 733 = 1648
4. 4913 + 3367 = 8280	5. 646 + 259 = 905	6. 1756 + 858 = 2614
7. $2378 + 2848 = $5226	8. $17.62 + 2.75 = $20.37	9. $37.41 + 36.89 = $74.30
10. 1063 + 121 + 4354 = 5538	11. 125 + 1365 + 2237 = 3727	12. 3623 + 1584 + 2173 = 7380
13. $1281 + 476 + 540 = $2297	14. $12.89 + 21.35 + 9.76 = $44.00	15. $ 3.78 + 18.98 + 28.56 = $51.32

Subtract.

16. 293 − 157 = 136	17. 2804 − 622 = 2182	18. 6167 − 2415 = 3752
19. 2274 − 856 = 1418	20. 495 − 198 = 297	21. 8318 − 3692 = 4626
22. 6335 − 5596 = 739	23. 1426 − 457 = 969	24. 3510 − 2915 = 595
25. 5000 − 1639 = 3361	26. 7051 − 4156 = 2895	27. 7203 − 3375 = 3828
28. $1003 − 298 = $ 705	29. $861 − 297 = $ 564	30. $4344 − 2468 = $1876
31. $8.44 − 1.73 = $6.71	32. $83.71 − 47.88 = $35.83	33. $70.00 − 64.84 = $ 5.16

Multiply.

1. 30 × 3 = 90	2. 20 × 4 = 80	3. 60 × 2 = 120
4. 30 × 5 = 150	5. 50 × 6 = 300	6. 600 × 4 = 2400
7. 30 × 7 = 210	8. 800 × 3 = 2400	9. 70 × 5 = 350
10. 700 × 6 = 4200	11. 40 × 8 = 320	12. 70 × 7 = 490
13. 90 × 8 = 720	14. 700 × 9 = 6300	15. 90 × 2 = 180

Divide.

16. 2)160 = 80	17. 3)60 = 20	18. 5)50 = 10
19. 3)120 = 40	20. 4)360 = 90	21. 4)160 = 40
22. 8)240 = 30	23. 6)180 = 30	24. 7)280 = 40
25. 8)560 = 70	26. 5)450 = 90	27. 9)270 = 30
28. 7)140 = 20	29. 9)720 = 80	30. 6)360 = 60

Solve.

31. A bag holds 60 biscuits. How many biscuits are in 9 bags? 540

32. 480 post cards are kept in 6 boxes. Each box has the same number of cards. How many are in each box? 80

33. The hobby shop sells 200 stamps in each packet. How many stamps are in 5 packets? 1000

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LESSON ACTIVITY

Using the Pages

- The exercises are arranged in four sections on these two pages. The skills are presented as follows.

Section 1	Addition	Subtraction
one regrouping	Ex. 1-3	Ex. 16-18
two regroupings	Ex. 4, 5, 8	Ex. 19-21
three regroupings	Ex. 6, 7, 9	Ex. 22-24
amounts of money	Ex. 7-9, 13-15	Ex. 28-33
more than two addends	Ex. 10-15	—
zeros in the minuend	—	Ex. 24-28, 31

Section 2	Multiplication	Division
extensions of basic facts	Ex. 1-15	Ex. 16-30
word problems	Ex. 31,33	Ex. 32

Section 3	Multiplication (standard algorithm)
no regrouping	Ex. 1-3
one regrouping	Ex. 4-6
more than one regrouping	Ex. 7-21
amounts of money, dollars	Ex. 22-24
amounts of money, dollars and cents	Ex. 25-30
word problems	Ex. 31, 32

Section 4	Word Problems
addition	Ex. 1, 8, 9, 10
subtraction	Ex. 2, 6
multiplication	Ex. 3, 5, 7, 9, 10
division	Ex. 4
more than one step	Ex. 8, 9, 10

Multiply.

1. 23 × 2 = 46	2. 310 × 3 = 930	3. 12 × 4 = 48
4. 14 × 7 = 98	5. 231 × 4 = 924	6. 107 × 5 = 535
7. 32 × 9 = 288	8. 53 × 8 = 424	9. 640 × 2 = 1280
10. 391 × 8 = 3128	11. 738 × 6 = 4428	12. 465 × 5 = 2325
13. 571 × 9 = 5139	14. 54 × 6 = 324	15. 729 × 7 = 5103
16. 498 × 3 = 1494	17. 42 × 8 = 336	18. 38 × 5 = 190
19. 507 × 4 = 2028	20. 694 × 9 = 6246	21. 612 × 6 = 3672
22. $265 × 3 = $795	23. $715 × 2 = $1430	24. $922 × 5 = $4610
25. $8.06 × 7 = $56.42	26. $8.49 × 4 = $33.96	27. $7.80 × 9 = $70.20
28. $0.96 × 6 = $5.76	29. $8.65 × 8 = $69.20	30. $4.62 × 7 = $32.34

Solve.

31. There were 288 apples in one carton. How many apples were in 6 cartons? 1728
32. Each jug of milk cost $1.45. How much did Barbara spend for 3 jugs of milk? $4.35

Solve.

1. Fern had 277 insects in her collection. Last summer she collected 86 more. Now how many does she have? 363
2. The scales showed 1845 kg for the empty truck and 2820 kg when the truck was loaded. How heavy was the load? 975 kg
3. There are 70 biscuits in each box. How many biscuits are there in 8 boxes? 560
4. Elsa, Rae, and Meg collected 210 rocks that they shared. How many rocks did each get? 70
5. Toby charged $3.19 for each kilogram of maple syrup. How much did he get for 7 kg? $22.33
6. Elliott's grocery bill was $15.48. How much change did he get from $20.00? $4.52
7. Lettered T-shirts cost $6.95. Yuri and Michel each bought one. How much did they spend? $13.90
8. A jacket costs $24.98. A pair of skates costs $5.00 more. How much do the jacket and the skates cost together? $54.96
9. At an "88¢ Sale", Russ bought 5 models and 2 brushes. He paid 88¢ for each item. How much did he spend in all? $6.16
10. Audrey is 9 years old today. 7 of the years had 365 d (days). 2 of the years had 366 d. How many days has it been since Audrey was born? 3287

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RELATED ACTIVITIES

- Choose from activities and games in preceding units for review and enrichment.

or the addition and subtraction exercises, emphasize accuracy and speed. Review any aspect of regrouping that students find difficult by adapting the lessons and activities on the appropriate pages.

For the extensions of basic multiplication and division facts, emphasize thinking of the related basic facts to facilitate the computation.

For the multiplication exercises that involve the standard algorithm, review regrouping procedures as needed. For the word problems, remind the students to determine what operation (or operations) is necessary to solve the problem. The answer for each problem should be stated in a sentence.

would likely be best to have the students complete each section at a different time over a period of several days. The sections could be followed with an activity selected from the corresponding unit. Note that the students' competence in working with whole numbers is important in developing similar skills with decimals in the next unit.

Unit 8 Overview

Decimals

This is the first unit in Book 4 in which decimals are considered formally. Earlier work with dollars and cents involved decimal notation although no attention was drawn to it at that time. In this unit, place value is studied in decimals showing tenths and hundredths, and equivalent forms of one-place and two-place decimals are considered. The decimal aspect of writing dollars and cents is pointed out and other monetary systems using decimal notation are offered as interesting information. Ordering and comparing decimals is presented by examining them in successive places from left to right. Addition, subtraction, and multiplication of decimals are based upon the principles learned for whole numbers, with the same procedures utilized in regrouping sums, minuends, and products. Rounding one-place decimals to the nearest whole number is presented as a basis for estimating sums and products. Skills in working with whole numbers are maintained by *Keeping Sharp* exercises in addition, subtraction, and multiplication. The last lesson in the unit introduces a trial-and-error approach as one method of solving problems.

Prerequisite Skills

- identify wholes that show ten equal parts
- write numerals for amounts of money to $9.99
- interpret dollars-and-cents notation
- compare and order whole numbers
- add and subtract whole numbers with regrouping
- complete basic multiplication facts
- use the standard algorithm to multiply a two-digit number by a one-digit number

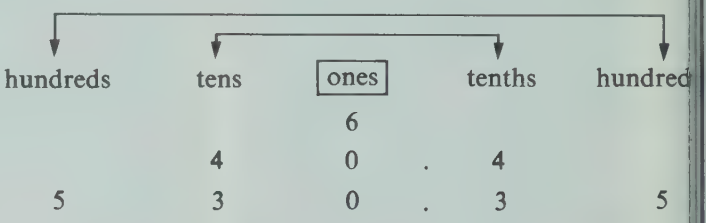
Unit Outcomes

- read and write decimal notation from 0.0 to 19.9 and from 0.00 to 19.99
- write tenths as hundredths and hundredths as tenths; interpret place value in two-place decimals to 9.99
- express amounts of money using two-place decimals (dollars-and-cents notation)
- read and interpret amounts of money in dollars and other decimal currencies
- compare and order decimals from 0.00 to 19.99
- add and subtract one-place decimals with regrouping, sums and minuends to 9.9; solve related word problems
- add and subtract two-place decimals with regrouping, sums and minuends to 99.99; solve related word problems
- multiply a one-place decimal to 9.9 by a whole number less than 10, using the standard form
- round one-place decimals to 19.9 to the nearest whole number
- round one-place decimal addends with two or three digits to estimate the sum
- round one-place decimal factors with two or three digits to estimate a product
- use a trial-and-error approach to find the correct answer

Background

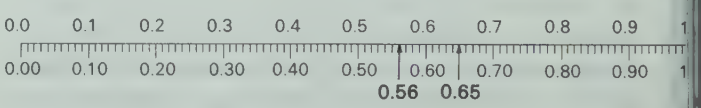
Decimals are being used more and more widely in everyday life in systems of measurement and money, particularly with the introduction of the metric system. In Unit 1, the concepts and numeration for common fractions, such as halves, fourths, fifths, and tenths, were reviewed. In this unit, decimals are introduced as a more convenient form for representing tenths and it is important that students acquire a good understanding of decimals and facility in using them.

The advantages of decimals over fractions lie in the structure of our numeration system which is a decimal (base-ten) system. A single digit, such as 6, represents ones; different place values are represented in every numeral that has more than one digit. Place-value positions to the left of ones represent whole numbers in powers of ten; those to the right of ones represent fractional numbers in powers of ten. Ones are in the central place, balanced on either side by tens and tenths, by hundreds and hundredths, and so on. A decimal point is inserted to separate the whole numbers from the fractional parts.



A decimal and a corresponding common fraction represent the same amount and are read in the same way. For example, $6\frac{4}{10}$ and $6\frac{4}{10}$ are read "six and four-tenths"; 3.12 and $3\frac{12}{100}$ are read "three and twelve-hundredths". Reading decimals in this way (rather than as "six point four", for example) emphasizes the meaning of the decimal and provides a link with place value. Note, that in the strictest sense, the word "decimals" usually refers to the numerals for decimal fractions (such as 0.7 and 3.2). For simplicity in this series, the word "decimals" is used when speaking of the rational numbers as well as the numerals. Decimals may be used to represent numbers less than one, numbers equal to one, and numbers greater than one, by naming the number of wholes, and the number and kind of the fractional parts. For example, 3.45 represents 3 wholes and 45 hundredths, and 9.0 (9.00) represents 9 wholes and 0 tenths (9 wholes and 0 hundredths). It should be pointed out that for decimals less than one, a zero is written in the ones' place; for example, 0.4 means "0 wholes 4 tenths" and is read "four-tenths".

Matching decimals with points on a number line helps in recognizing equivalent decimals and in comparing and ordering them. On the number line shown, 0.4 is seen to be equivalent to 0.40. By their positions on the number line, it is relatively easy to compare 0.65 and 0.56 and to determine which is greater.



The number line is also useful in connection with rounding decimals to whole numbers. The numbers 0.8 and 1.1 are closer to 1 and both are rounded to 1. Although the number 0.5 is halfway between 0 and 1, it is generally agreed that it should be rounded upward to 1, as are 0.6, 0.7, 0.8, and 0.9. These concepts for rounding are particularly important for work with estimation involving decimals. Estimating a sum or a product, for example, provides a means of assessing the "reasonableness" of an answer, and, most important, helps in placing the decimal point in the answer.

ince decimal notation is an extension of the familiar base-ten cture for whole numbers, the regrouping procedures used in le number operations are equally valid for decimals. lying the concepts of place value and regrouping to rations with decimals shortens the traditional approach to the rithms. It replaces expressing decimals as fractions with ominators of ten or one hundred to explain the algorithms. In tion and subtraction algorithms, place values of the numbers d to be lined up. This is easily done by lining up the decimal ts, but emphasis should be placed on aligning the place es. Regrouping sums and minuends is done in the same way decimals as with whole numbers.

1 23 + 19 42	1 2.3 + 1.9 4.2
1 1 146 + 257 403	1 1 1.46 + 2.57 4.03
3 11 13 4 2 3 − 1 7 5 2 4 8	3 11 13 4. 2 3 − 1. 7 5 2. 4 8

ultiplication of decimals is also performed in the same ner as with whole numbers. It is not necessary, however, to n the place values of the multiplier and the multiplicand, but decimal place values in the product must reflect the values in numbers. For instance, if 6 tenths is multiplied by 4, the duct of 4 and 6 (24) must show tenths (2.4). The work in this is limited to multiplying a one-place decimal by a whole ber; the more advanced level of having decimals in both the tiplier and multiplicand is deferred to a later level.

elationships between numbers in an abstract manner are ise and unvarying. For example, the sum of 6 and 7 is ays 13, whether they be whole numbers ($6 + 7 = 13$), mals ($0.6 + 0.7 = 1.3$), or fractions ($\frac{6}{8} + \frac{7}{8} = \frac{13}{8}$). mber relationships are also unvarying in the three other basic rations. However, in the application of numbers to real life, e fixed results frequently need to be adjusted according to circumstances. For example, if 18 cans of paint are to be ped in cartons which hold 4 cans, the quotient of the sion, $18 \div 4 = 4$ R2, must be increased by 1; 4 cartons can 16 cans, but another carton is needed for the remaining 2 to be shipped. On the other hand, if 18 litres of paint are lable to fill cans with a capacity of 4 litres each, the number lled cans is only 4; the remainder, in this case, is ignored. re are many situations in real life where precise mathemat- results must be adjusted, and the *Problem Solving* feature on 199 challenges the students to make such adjustments. The blem-solving skill presented at the end of this unit is entitled ess and Test'', which summarizes in simple language a very ctive skill. It is essentially the same skill identified as ''trial error'' or ''the scientific method'', and has also been called elligent guessing''. Students need opportunities to develop a skill under careful guidance, using intelligent analysis of n conditions to arrive at a solution.

ching Strategies

lodels for ones, tenths, and hundredths can be of value in ing students in their study of decimals, particularly the e-value relationships which exist between the several places. Numerals by themselves reveal nothing of the base-ten structure of the system. It is through models that the relationships can be seen and learned. A description for preparing these models is given below. The models are similar to the ones first illustrated on pages 174 and 176. They have been developed to assist in the part-of-a-whole concept for tenths and hundredths.

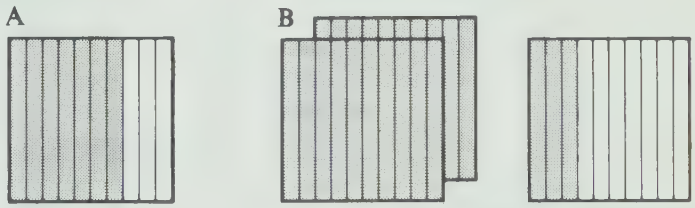
Number lines showing ones and tenths, as well as ones, tenths, and hundredths, can be used for several lessons in the unit. Both types of number lines should have the same scale so that equivalent decimals may be spotted easily by placing one number line along another.

The illustrations of coins from several countries using decimal money systems may lead to interesting research activities. Non-decimal systems should be included so that some of the advantages of a decimal system may be recognized.

Since operations with decimals utilize the same basic facts as for whole numbers, any weaknesses which were apparent in earlier units will likely recur. It is important, therefore, that any errors in the exercises with decimals be diagnosed as to their causes. Specific items developed in the unit are listed in the chart on page T 217 and appropriate follow-up activities should be planned for any identified needs.

Models for Ones, Tenths, and Hundredths

To represent one-place decimals such as 0.7 and 2.3, make white models and blue models using copies of page T 364. To show 0.7, cut a blue model into tenth strips and place 7 blue tenth strips on a white model (A). To show 2.3, display 2 blue whole models and then place 3 blue tenth strips on a white model (B). Being able to move the tenth strips allows the students to show regrouping of 10 tenths as 1 whole (or vice versa). Also, it enables them to place tenth strips over hundredths to illustrate equivalent decimals such as 0.2 and 0.20.



To represent two-place decimals such as 0.34 and 1.76, make white models and blue models using copies of page T 365. To show 0.34, use a white model and color 34 of the 100 squares blue. To show 1.76, display one blue whole model and color 76 of the 100 squares blue on a white model.

Materials

models for ones, tenths, and hundredths as described above
real money, play money, or cutouts from pages T 351 and T 352 (optional)
copies of the unmarked number line for tenths and hundredths from page T 359 (optional)
tracing paper

Vocabulary

decimals	one-place decimal	hundredths
decimal point	two-place decimal	estimate

Pages 174-175

LESSON OUTCOME

Read and write decimal notation from 0.0 to 19.9

Materials

models for ones and tenths prepared with copies of page T 364 as described on page T 187

Vocabulary

decimals, decimal point, one-place decimal

Prerequisite Skills

Identify wholes that show ten equal parts

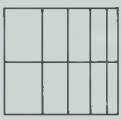
Checking Prerequisite Skills

Which of these show tenths?

1. no

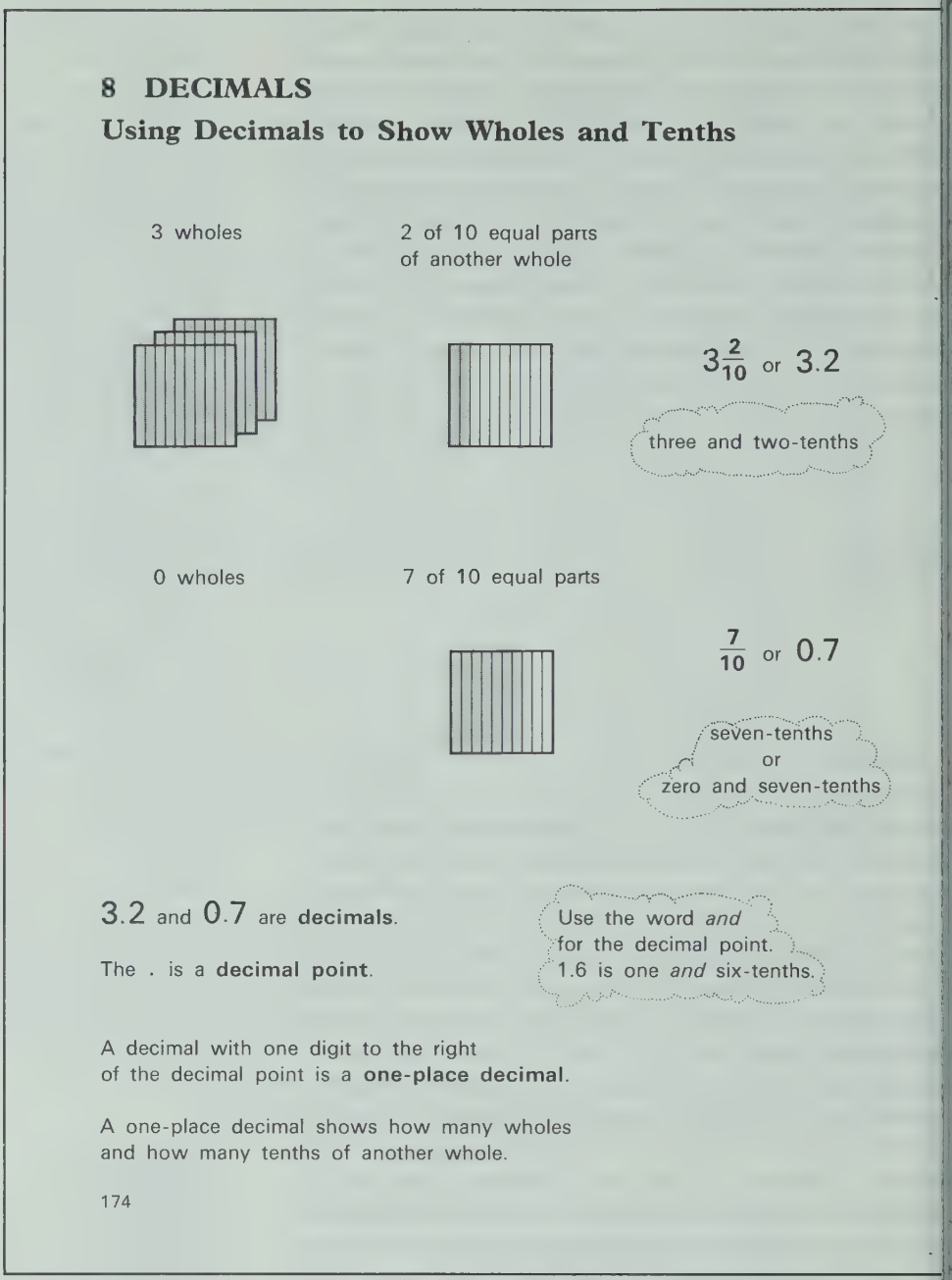
2. yes

3. yes

4.  no

Background

In the strictest sense the word "decimals" usually refers to the numerals for decimal fractions such as 0.7 and 3.4. For simplicity in this series, the word "decimals" is used when speaking of the rational numbers as well as the numerals.



8 DECIMALS

Using Decimals to Show Wholes and Tenths

3 wholes

2 of 10 equal parts of another whole

$3\frac{2}{10}$ or 3.2

three and two-tenths

0 wholes

7 of 10 equal parts

$\frac{7}{10}$ or 0.7

seven-tenths
or
zero and seven-tenths

3.2 and 0.7 are **decimals**.

The . is a **decimal point**.

Use the word *and* for the decimal point. 1.6 is one *and* six-tenths.

A decimal with one digit to the right of the decimal point is a **one-place decimal**.

A one-place decimal shows how many wholes and how many tenths of another whole.

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LESSON ACTIVITY

Before Using the Pages

- Use models to show tenths less than one, for example, one-tenth or six-tenths, by placing the appropriate number of tenth strips on the ones' model. Review the word name and the fraction, emphasizing that each names the same number.

  Use a similar procedure to review wholes and tenths, for example, two and three-tenths. Also demonstrate that one whole is the same as ten-tenths. Vary the procedure by representing fractions and having the students name them. Also, name fractions and have the students represent them.

  Explain that since tenths are used in many instances in everyday life, a shorter way of writing them was developed. Some students may be able to suggest the term *decimals*.

Using the Pages

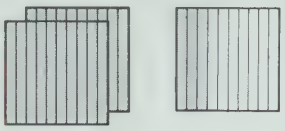
- Discuss the illustration for 3.2. Ask how many wholes shown and then how many tenths are shown. Review fraction numeral $3\frac{2}{10}$. Then have the students contrast with the numeral 3.2 by suggesting how it involves writing. Emphasize that the dot is placed to separate wholes from the tenths, and that the same word name, *and two-tenths*, refers to both $3\frac{2}{10}$ and 3.2.

  Discuss the illustration for 0.7 in a similar manner. Po out that when there are no wholes, a zero is always sho to the left of the dot. Note the two ways of readin decimal less than one.

  Introduce the terms *decimals*, *decimal point*, *one-place decimal*. Draw attention to the use of the w *and* for the decimal point. Ask the students what one-place decimal shows, and then read the rela statement at the bottom of page 174.

Working Together

How many wholes? How many tenths?
Give the one-place decimal.

1. 
holes and
enths;

2.
0 wholes and
5 tenths;
0.5

Write the decimals.

3. eight-tenths 0.8
4. four and one-tenth 4.1

Write the words.

5. 2.7 6. 11.1 7. 0.9

5. two and seven-tenths
6. eleven and one-tenth
7. nine-tenths

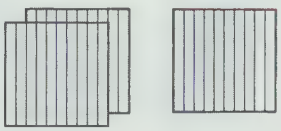
Exercises

How many wholes? How many tenths?
Write the one-place decimal.

1.
hole and
enths,

2.
0 wholes and
2 tenths;
0.2

3.
holes and
nth,

4. 
2 wholes and
8 tenths;
2.8

Write the decimals.

5. one and nine-tenths 1.9
6. three-tenths 0.3
7. two and one-tenth 2.1
8. three and four-tenths 3.4
9. six-tenths 0.6
10. ten and two-tenths 10.2
11. thirteen and seven-tenths 13.7

Write the words.

12. 4.3 13. 0.8 14. 5.5
15. 0.1 16. 12.6 17. 14.9

Write the decimals.

18. Colin rode three and four-tenths kilometres. 3.4
19. Diana painted four of the ten sections of the fence. 0.4

12. four and three-tenths
13. eight-tenths
14. five and five-tenths
15. one-tenth
16. twelve and six-tenths
17. fourteen and nine-tenths

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RELATED ACTIVITIES

- The students may complete charts similar to the following for extra practice.

Words	Fraction	Decimal
six-tenths	$\frac{6}{10}$	0.6
	$3\frac{3}{10}$	

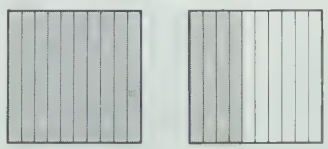
- Students may work in pairs using models for wholes and tenths. One student displays models for a number and the other names the number. Each student writes the decimal and then they compare their answers.
- Small groups of students may play the game "Show Me" using models for wholes and tenths, cards showing fraction numerals, and cards showing decimal numerals. One student states, "Show me the decimal (fraction) (picture) for one and five-tenths." The other students display the cards requested.

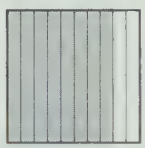
rking Together: Ex. 1 and 2 deal with writing the decimal for a given illustration. Note that the instructions emphasize that the ones are considered first and then the tenths. This establishes the order of writing the corresponding numeral from left to right and helps students to remember the zero for zero wholes. It also helps them to place the decimal point correctly. Ex. 3 and 4 deal with writing a decimal, given the word name. Ex. 5-7 deal with this skill in the opposite sense, namely, given the decimal numeral, write the word name. Use other similar exercises, as needed. You may wish to have the students use models to represent the numbers in Ex. 3-7.

rcises: Since a one-place decimal is required for Ex. 1-4, the students must show the zero for zero wholes in Ex. 2. Ensure that the students do not show a raised dot for the decimal point. The dot should be placed with care in its correct position in each numeral.

Assessment

Write the one-place decimal.

1. 
1.4

2. 
0.8

3. two and three-tenths 2.3
4. ten and five-tenths 10.5
5. nine-tenths 0.9

Write the words.

6. 11.4 7. 0.7 8. 0.3

6. eleven and four-tenths
7. seven-tenths
8. three-tenths

Pages 176-177

LESSON OUTCOME

Read and write decimal notation from 0.00 to 19.99

Materials

models for ones, tenths, and hundredths; a model for 0.18 made from copies of pages T364 and T365 as described on page T 187; models for 1.2 and 1.20 (optional)

Vocabulary

hundredths, two-place decimal

Prerequisite Skills

Read and write decimal notation from 0.0 to 19.9

Checking Prerequisite Skills

Write the decimals.

1. two-tenths 0.2
2. five and eight-tenths 5.8

Write the words.

3. 6.6 six and six-tenths
4. 0.1 one-tenth

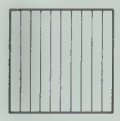
Background

The previous lesson introduced one-place decimals for showing the number of wholes and the tenths of another whole. Now the same wholes are seen divided into one hundred equal parts and two-place decimals are introduced. The relationship between tenths and hundredths is introduced in the following lesson.

Using Decimals to Show Wholes and Hundredths

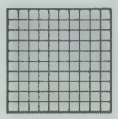
1 whole

3 of 10 equal parts of another whole

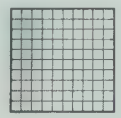


$1\frac{3}{10}$ or 1.3

1 whole



30 of 100 equal parts of another whole



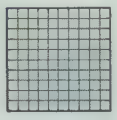
$1\frac{30}{100}$ or 1.30

one and thirty-hundredths

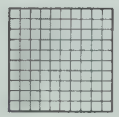
1.30 is a **two-place decimal.**

A two-place decimal has two digits to the right of the decimal point and shows how many hundredths.

1 whole



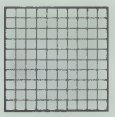
34 hundredths



$1\frac{34}{100}$ or 1.34

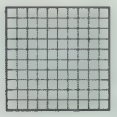
0 wholes

95 hundredths

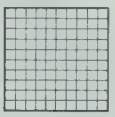


$\frac{95}{100}$ or 0.95

1 whole



2 hundredths



$1\frac{2}{100}$ or 1.02

176

LESSON ACTIVITY

Before Using the Pages

- Display a whole model showing tenths. Review that it has ten equal parts, each called a tenth.

  Display a whole model showing hundredths. Ask whether the parts are equal and how many parts there are. (Point to each part as the students count aloud. They will likely count by tens once they realize each row has ten squares.) Summarize that the whole is divided into one hundred equal parts.

- Display a model for 0.18. Ask if the parts are equal and how many of the parts are blue. (Point to the blue squares as the students count aloud.) Ask how they might name the number represented. They may suggest "18 blue parts of 100 equal parts of a whole", or "eighteen-hundredths".

Using the Pages

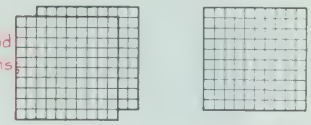
- The page begins with the same whole shown first divided into tenths and then divided into hundredths. Although 1.3 1.30 represent the same amount, this aspect is emphasized at this time. Have the students note the nun of equal parts and the number of blue parts for each establish that hundredths are named by two-place decim and tenths by one-place decimals. Emphasize tha two-place decimal has two digits to the right of the deci point.

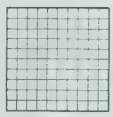
- Discuss each of the three illustrations for hundredths seer the lower half of page 176. Have the students contrast fraction and the decimal numeral for each. Ask what th in 0.95 indicates. Help students to understand the zero 1.02 by questioning them and having them write numer as follows.

  "What kind of decimal shows tenths?"
  "Show the decimal for one and two-tenths."
  "What kind of decimal shows hundredths?"
  "Show the decimal for one and twenty-hundredths."
  "Show the decimal for one and two-hundredths."

Working Together

How many wholes? How many hundredths?
Give the two-place decimal.

1. 
wholes and hundredths; 1.08

2. 
0 wholes and 45 hundredths; 0.45

Write the decimals.

3. twenty-five hundredths 0.25
4. three and seven-hundredths 3.07

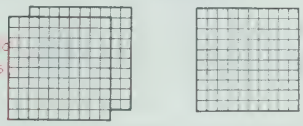
Write the words.

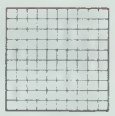
5. 0.75 6. 2.04 7. 0.07

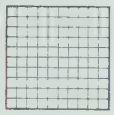
5. seventy-five hundredths
6. two and four-hundredths
7. seven-hundredths

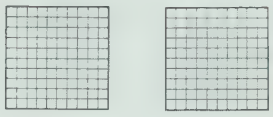
Exercises

How many wholes? How many hundredths?
Write the two-place decimal.

1. 
wholes and hundredths; 1.72

2. 
0 wholes and 61 hundredths; 0.61

3. 
0 wholes and 3 hundredths; 0.03

4. 
1 whole and 80 hundredths; 1.80

Write the decimals.

5. four and fifty-hundredths 4.50
6. two and twenty-eight hundredths 2.28
7. eighty-nine hundredths .89
8. seven and one-hundredth 7.01
9. five-hundredths .05
10. ten and fifteen-hundredths 10.15
11. twelve and seventy-hundredths 12.70

Write the words.

12. 1.55 13. 0.11 14. 4.20
15. 0.06 16. 13.36 17. 11.09

Write the decimals.

18. The soap is said to be ninety-nine hundredths pure. 0.99
19. A nickel is five-hundredths of a dollar. 0.05

12. one and fifty-five hundredths
13. eleven-hundredths
14. four and twenty-hundredths
15. six-hundredths
16. thirteen and thirty-six hundredths
17. eleven and nine-hundredths

177

RELATED ACTIVITIES

- Have students search magazines and newspapers for examples of decimal tenths and hundredths. Illustrations can be used along with the examples to make an attractive display. Newspaper clippings, weather charts, sports statistics, and automobile odometers are suitable examples. Daily additions to the display would encourage interest and motivate discussions for review.
- Adapt the activities in *Related Activities* on page T189 for use with hundredths.
- For reinforcement, prepare a work sheet asking the students to draw lines to match items in a list of decimals and a list of word names.
- Some students may be interested in completing other exercises similar to Ex. 19. Provide them with statements similar to the following.

1. A penny is one-hundredth of a dollar.
2. A dime is ten-hundredths of a dollar.
3. A quarter is twenty-five hundredths of a dollar.

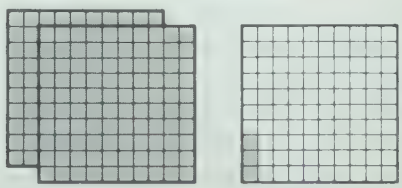
This will enable the students to note the differences in the numerals 1.2, 1.20, and 1.02, and help them to understand the meaning of each. Use models for 1.2 and 1.20, if necessary.

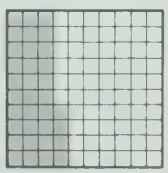
rking Together: Ex. 1 and 2 deal with writing the decimal for a given illustration and emphasize the order of naming the ones first and then the hundredths. Ex. 3-7 deal with writing decimals given the word names and vice versa. Pay particular attention to Ex. 4, 6, and 7 which involve hundredths less than ten-hundredths. Use other similar exercises as needed.

rcises: Some students may need to be reminded to show a hyphen in the word names and a zero to the left of the decimal point in exercises such as Ex. 7. Note that Ex. 9 requires two zeros — one for wholes and one in the tenths' place.

Assessment

Write the two-place decimal.

1. 
2.03

2. 
0.34

3. eleven-hundredths 0.11
4. six and eighty-hundredths 6.80
5. one and nine-hundredths 1.09

Write the words.

6. 15.42 7. 8.20 8. 0.06

6. fifteen and fourty-two hundredths
7. eight and twenty-hundredths
8. six hundredths

Pages 178-179

LESSON OUTCOME

Write tenths as hundredths and hundredths as tenths; interpret place value in two-place decimals to 9.99

Materials

10 blue tenth strips, a white hundredths model, models for 0.36 and 0.78

Prerequisite Skills

Read and write one-place and two-place decimals

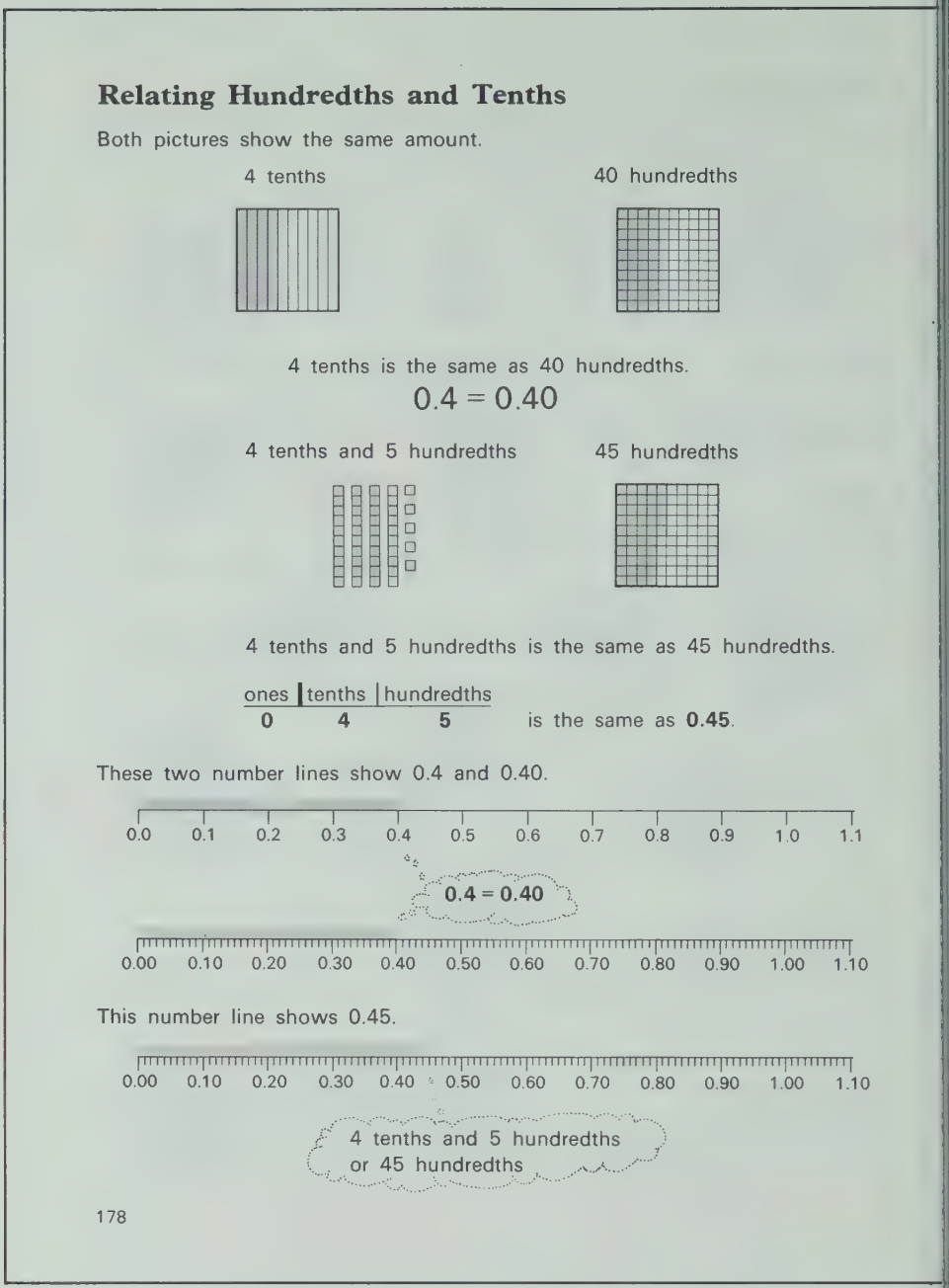
Checking Prerequisite Skills

Write the decimals.

1. one and two-tenths 1.2
2. five-tenths 0.5
3. one and two-hundredths 1.02
4. twenty-hundredths 0.20

Write the words.

5. 18.9 eighteen and nine-tenths
6. 5.08 five and eight-hundredths
7. 11.65 eleven and sixty-five hundredths



Relating Hundredths and Tenths

Both pictures show the same amount.

4 tenths

40 hundredths

4 tenths is the same as 40 hundredths.

$0.4 = 0.40$

4 tenths and 5 hundredths

45 hundredths

4 tenths and 5 hundredths is the same as 45 hundredths.

ones	tenths	hundredths
0	4	5

is the same as **0.45**.

These two number lines show 0.4 and 0.40.

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1

0.4 = 0.40

0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10

This number line shows 0.45.

0.00 0.10 0.20 0.30 0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10

4 tenths and 5 hundredths or 45 hundredths

178

LESSON ACTIVITY

Before Using the Pages

- Ask questions similar to the following and have students use models to demonstrate the answers.
  "How many hundredths are covered by one tenth strip?"
  "How many hundredths are covered by two tenth strips?"
  "How many hundredths are the same as one-tenth?"
  "How many hundredths are the same as two-tenths?"
  "How many tenths are the same as thirty-hundredths?"
  "How many tenths are the same as seventy-hundredths?"
  "For thirty-six hundredths, how many hundredths can be matched with tenth strips? How many tenth strips are needed? How many hundredths are left over? How many tenths and hundredths are the same as 36 hundredths?"
  "How many tenth strips can be used to help show 78 hundredths? How many tenths and hundredths are the same as 78 hundredths?"

Using the Pages

- Tenths and hundredths are related in the example by mean illustrations of models, a place-value chart, and the num line. Use the illustrations of models to review the part whole relationship. For example, 4 tenths of a whole is same as 40 hundredths of the same whole.

  Relate each digit of the numeral 0.45 to the corresp ing digit in the place-value chart. Ask why the separating the ones and tenths in the chart is thicker than bar between the tenths and the hundredths. Emphasize this helps to separate the numeral into two parts just as decimal point does. You may wish to draw a place-va chart on the board to represent the numbers discusse *Before Using the Pages*.

  Discuss each number line, in turn, noting the scale each. Point out that 0.45 can be located by thinking counting only by hundredths to forty-five hundredths, or thinking of tenths to four-tenths and then by hundred

Working Together

Complete.

1. 7 tenths = 70 hundredths 70 hundredths
2. 2 tenths = ▒ hundredths 20 hundredths
3. 50 hundredths = ▒ tenths 5 tenths
4. 0.25 shows 2 tenths 5 hundredths, or 25 hundredths. 2 tenths 5 hundredths; 25 hundredths
5. 0.16 shows ▒ tenth ▒ hundredths, or ▒ hundredths. 1 tenth 6 hundredths; 16 hundredths

Exercises

Write each of these as hundredths.

1. 0.8 0.80
2. 0.1 0.10
3. 0.9 0.90
4. 0.3 0.30
5. 0.6 0.60
6. 0.2 0.20

Write each of these as tenths.

7. 0.60 0.6
8. 0.30 0.3
9. 0.80 0.8
10. 0.70 0.7
11. 0.10 0.1
12. 0.90 0.9

Complete the sentences.

13. 0.58 shows 5 tenths 8 hundredths, or 58 hundredths. 5 tenths 8 hundredths; 58 hundredths
14. 0.30 shows ▒ tenths ▒ hundredths, or ▒ hundredths. 3 tenths 0 hundredths; 30 hundredths
15. 0.09 shows ▒ tenths ▒ hundredths, or ▒ hundredths. 0 tenths 9 hundredths; 9 hundredths
16. 3.50 shows ▒ ones ▒ tenths ▒ hundredths, or 3 and ▒ hundredths. 3 ones 5 tenths 0 hundredths; 3 and 50 hundredths

Write each as a one-place decimal.

17. 3.20 3.2
18. 9.30 9.3
19. 2.40 2.4
20. 7.70 7.7
21. 12.10 12.1
22. 13.50 13.5

Write each as a two-place decimal.

23. 1.7 1.70
24. 6.4 6.40
25. 4.5 4.50
26. 10.1 10.10
27. 5.2 5.20
28. 11.8 11.80

Add.

1. 36 + 16 = 52
2. 43 + 86 = 129
3. 86 + 77 = 163
4. 125 + 88 = 213
5. 192 + 655 = 847
6. 277 + 375 = 652
7. 788 + 439 = 1227
8. 5933 + 647 = 6580
9. 4566 + 4742 = 9308
10. 4487 + 2949 = 7436
11. 1207 + 3275 + 318 = 4800
12. 1823 + 746 + 2614 = 5183

Subtract.

13. 584 − 55 = 529
14. 750 − 364 = 386
15. 471 − 285 = 186
16. 900 − 278 = 622
17. 4200 − 352 = 3848
18. 3637 − 674 = 2963
19. 6717 − 3946 = 2771
20. 9620 − 5727 = 3893
21. 9000 − 3415 = 5585
22. 7050 − 2681 = 4369

KEEPING SHARP

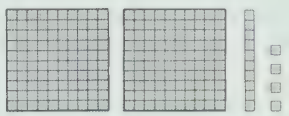
179

RELATED ACTIVITIES

- Have the students complete a work sheet similar to the following.

Ones	Tenths	Hundredths	Decimal
0	3	9	0.39
0	0	6	
			4.20

- Have students use models to represent each of the numbers in Ex. 1-12 and Ex. 17-28 on page 179. If students work in pairs, one may use models of ones and tenths, and the other may use models of ones and hundredths. The two ways of showing each number would be displayed.
- Have students write the decimals to match diagrams of models.



2.14

Have the students point to various numbers on each number line (7 tenths, 90 hundredths, 65 hundredths, 8 tenths and 4 hundredths).

rking Together: Ex. 1-3 deal with writing tenths as hundredths and vice versa. You may wish to have the students identify the corresponding points on the number lines on page 178. Ex. 4 and 5 emphasize the value of each digit in a two-place decimal. Represent each of these, using models of tenths and hundredths as required.

ercises: The numbers in Ex. 1-12 are less than one. In Ex. 17-28, they are greater than one. Note that for both sets of exercises, the instructions are worded differently, but they imply the same skill.

eping Sharp: These exercises help to maintain skills in addition and subtraction of whole numbers with regrouping. They also prepare students for applying similar skills with decimals later in this unit.

Assessment

1. Write 0.5 as hundredths. 0.50
2. Write 0.40 as tenths. 0.4
3. Write 7.30 as a one-place decimal. 7.3
4. Write 12.2 as a two-place decimal. 12.20

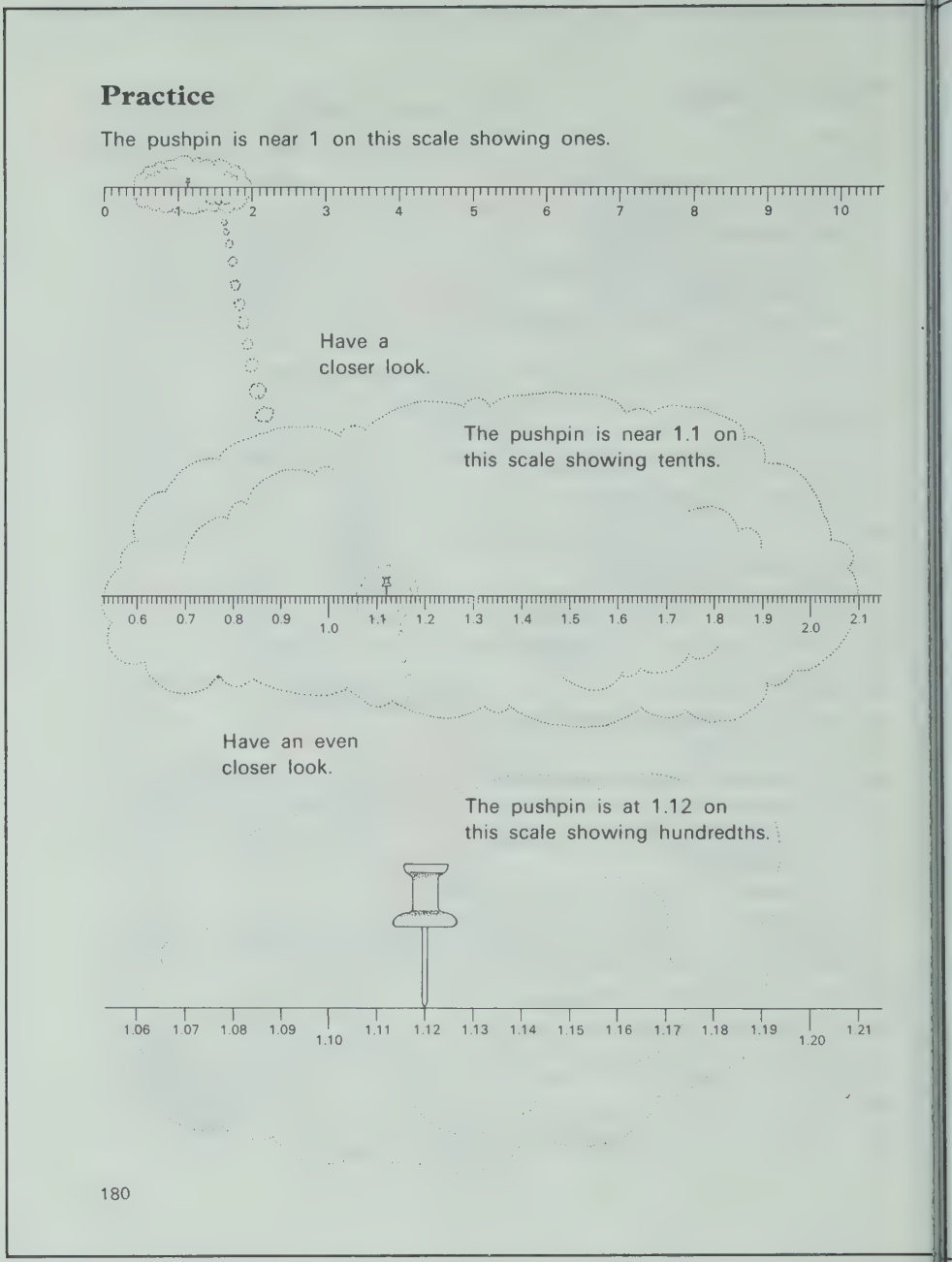
Complete.

5. 0.42 shows 4 tenths 2 hundredths, or 42 hundredths.
6. 9.08 shows 9 ones 0 tenths 8 hundredths, or 9 and 8 hundredths.

Pages 180-181

OBJECTIVE

Demonstrate competence in reading and writing decimal tenths and hundredths


Practice
The pushpin is near 1 on this scale showing ones.
0 1 2 3 4 5 6 7 8 9 10
Have a closer look.
The pushpin is near 1.1 on this scale showing tenths.
0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2.0 2.1
Have an even closer look.
The pushpin is at 1.12 on this scale showing hundredths.
1.06 1.07 1.08 1.09 1.10 1.11 1.12 1.13 1.14 1.15 1.16 1.17 1.18 1.19 1.20 1.21
180

LESSON ACTIVITY

Using the Pages

- Direct the students' attention to the first number line. Ask whether the pushpin is closer to 1 or to 2. Develop that by taking a closer look at this part of the number line, the position of the pushpin can be determined more precisely. You may wish to suggest that this is similar to using a magnifying glass to observe something more closely.

  For the second number line, have the students place one finger on the point for 1 and another on the point for 2. Discuss that these are given as 1.0 and 2.0 because this enlarged part of the first number line shows tenths. Establish that the pushpin is between 1.1 and 1.2, but it is closer to 1.1.

  For the third number line, have the students tell how 1.1 and 1.2 are named in this even closer look at part of the original number line. Develop that the scale marked in hundredths shows the exact location of the pushpin.

- Name several points and have the students locate them on e of the number lines, in turn, to practice reading the scale each line.

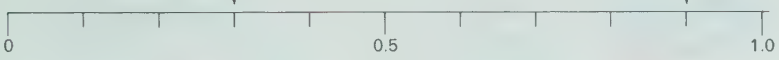
Exercises: You may wish to discuss one or more of the exerci with the students before they begin to work independent For example, for Ex. 1, discuss that only part of the scal shown and ask whether the completed scale would sh ones, tenths, or hundredths. Then have the students co by tenths from zero to find the decimals indicated at poi A and B.

Note that Ex. 1 and 2 show the same segment of number line but in Ex. 2, hundredths are marked.

Exercises

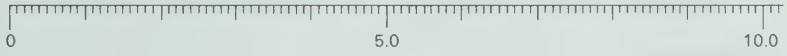
Write a decimal for each point marked with an arrow.

1. A 0.3 B 0.9

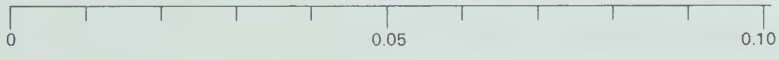


2. C 0.20 D 0.80

3. E 2.5 F 6.5



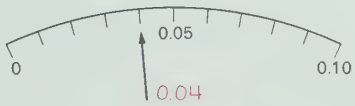
4. G 0.01 H 0.09



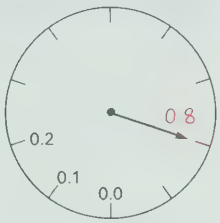
5.

6.

7.



8.

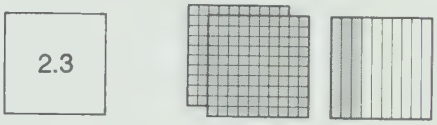


9.

181

RELATED ACTIVITIES

- The scales in the exercises on page 181 present a practical application of decimals. Students may be able to collect or list examples of the uses of such scales in everyday life, for example, scales for measuring the mass of foods, postal scales, stop watches.
- Students who experienced difficulty with these pages may find it helpful to complete similar exercises involving only whole numbers at first. These were presented in the problem solving feature on pages 168 and 169.
- Have students prepare cards to represent decimal tenths and hundredths using copies of pages T 364 and T 365 as described on page T 187. Also, have them use the decimetre squares on page T 363 to prepare decimal numeral cards for various decimal tenths and hundredths. The cards may be used in activities to reinforce the concept of decimals. For example, students may work in pairs, one student showing the decimal numeral and the other showing the model of the decimal.



Pages 182-183

LESSON OUTCOME

Express amounts of money using two-place decimals (dollars-and-cents notation)

Materials

real money, play money, or cutouts from pages T 351 and T 352 (optional)

Prerequisite Skills

Write numerals for amounts of money to $9.99; interpret dollars-and-cents notation

Checking Prerequisite Skills

Complete.

1. two dollars and ninety-five cents = $ 2 . 9 5
2. one dollar and thirty cents = $ 1 . 3 0
3. $4.06 = 4 dollars and 6 cents
4. $8.00 = 8 dollars
5. $0.64 = 64 cents
6. twenty-five cents = $ 0 . 2 5

Decimals and Money

Malina, Kevin, and Dion each have $1.37.

Malina has 1 dollar 3 dimes 7 pennies.

The dollar sign and the decimal help show the value of money.

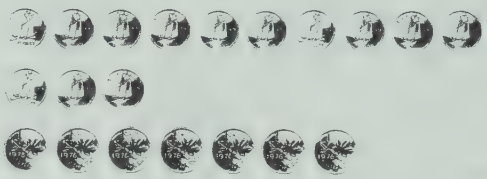
$1.37

Kevin has 1 dollar 2 dimes 17 pennies.

17 pennies have the same value as 1 dime 7 pennies.

$1.37

Dion has 13 dimes 7 pennies.



13 dimes have the same value as 1 dollar 3 dimes.

$1.37

182

LESSON ACTIVITY

Using the Pages

- This lesson involves the use of dollars-and-cents notation for amounts less than one dollar as well as amounts equal to or greater than one dollar. Thus, numerals such as $0.05 will be encountered.

  Begin with a discussion of Malina's amount of money. Ask for the name of each kind of coin and bill and their respective values. Ask how many pennies have the same value as one dime, how many pennies have the same value as one dollar, and how many dimes have the same value as one dollar. Establish that a penny is one-hundredth the value of a dollar and one-tenth the value of a dime, and a dime is one-tenth the value of a dollar. This will help the students to understand the significance of each digit in the numeral $1.37, and relate each to the number of dollars, dimes, and pennies Malina has. Discuss how the decimal point separates the dollars from the cents, in other words, amounts equal to or greater than one dollar are separa from amounts less than one dollar.

  A discussion of Kevin's amount of money will invo regrouping 10 pennies as 1 more dime. For Dion's amou 10 dimes will be regrouped as 1 dollar. Emphasize t although the three children have different sets of coins a bills, each has the same amount of money and the sa numeral ($1.37) represents each amount. Point out t $1.37 means 1 and 37 hundredths dollars, but that it customary to read this and other similar numerals as doll and cents.

Working Together: For Ex. 1, discuss that the answer $1. implies one and thirty-one hundredths dollars, but is re "one dollar and thirty-one cents". Some students may ne to use play money to help them answer Ex. 2 and 3. Ha them give the value of each amount in these exercises justify an answer of "Yes" or "No". It would worthwhile to have a few students explain how they arriv at their answers. Ex. 4 requires one regrouping and Ex.

Working Together

Use a dollar sign and a decimal to show the value of the money.

.31 1.

Are the two amounts the same?

2. 1 dollar 5 dimes 16 pennies and 16 dimes 5 pennies no
3. 2 dollars 11 dimes 12 pennies and 3 dollars 2 dimes 2 pennies yes

What is the value of

4. 1 dollar 19 dimes 8 pennies? $2.98
5. 1 dollar 13 dimes 15 pennies? $2.45

Exercises

Match.

1. 1 dollar 4 dimes 6 pennies B
2. 1 dollar 4 dimes 14 pennies D
3. 14 dimes 15 pennies A
4. 16 dimes 4 pennies C

A	1 dollar 4 dimes 15 pennies
B	14 dimes 6 pennies
C	15 dimes 14 pennies
D	1 dollar 5 dimes 4 pennies

Copy and complete the charts.

	Dollars	Dimes	Pennies	Value
5.	2	6	0	$2.60
6.	0	4	0	$0.40?
7.	4	0	0	$4.00?
8.	0	1	9	$0.19?
9.	0	0	5	$0.05?
10.	3	0	2	$3.02?

	Dollars	Dimes	Pennies	Value
11.	1	0	13	$1.13?
12.	0	11	3	$1.13?
13.	3	18	1	$4.81?
14.	1	17	12	$2.82?
15.	0	10	4	$1.04?
16.	2	9	10	$3.00?

Solve.

17. Penny has a dollar, 3 dimes, and 19 pennies. What is the value of her money? $1.49
18. Lyle has a dollar and 4 dimes in one pocket. He has 3 dimes and 13 pennies in another. How much does he have in all? $1.83
*19. How many dollar bills, dimes, and pennies do Malina, Kevin, and Dion have? What is the value of their money? 2 dollar bills, 18 dimes, 31 pennies; $4.11
*20. Michele has 2 dollars, 5 dimes, and 12 pennies. Jeffrey has 1 dollar, 16 dimes, and 14 pennies. How much do they have together? $5.36

183

RELATED ACTIVITIES

- Students may work in pairs using play money or cutouts from pages T 351 and T 352. One student displays coins and bills. The other student writes the two-place numeral, regrouping first if necessary. Amounts should not exceed $9.99.

requires two regroupings. Encourage the students to regroup the pennies first and then the dimes. Use similar exercises as required.

ercises: Ex. 1-4 involve matching equal amounts of money. You may wish to have the students write the value for each matching pair. Regrouping is not required in Ex. 5-10, but it is in Ex. 11-16. Ex. 19 and 20 involve more than one step and the operation of addition.

sessment

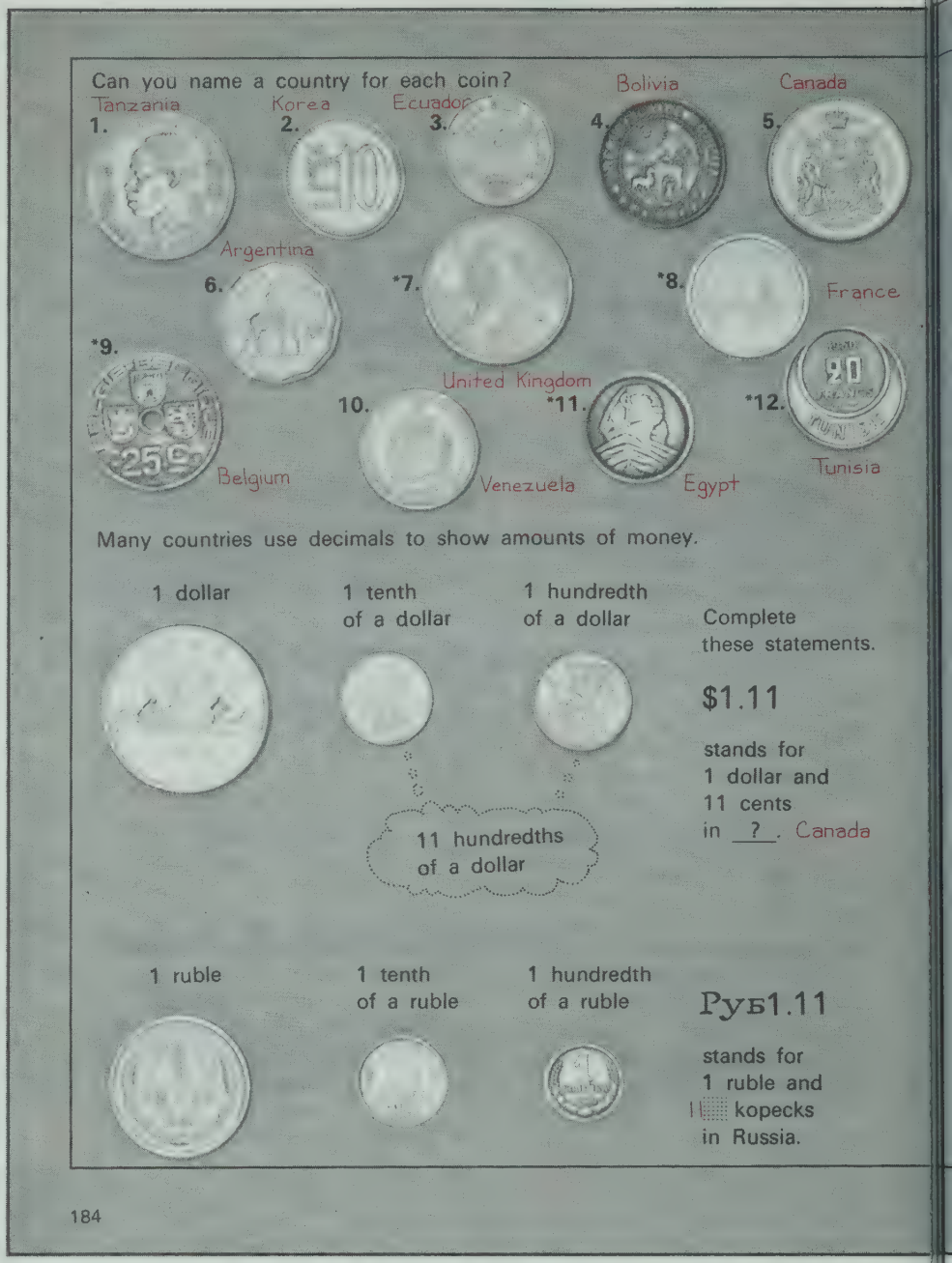
py and complete the chart.

Dollars	Dimes	Pennies	Value	
3	5	7	?	$3.57
0	0	6	?	$0.06
0	14	9	?	$1.49
1	3	12	?	$1.42
1	12	14	?	$2.34

Pages 184-185

OBJECTIVE

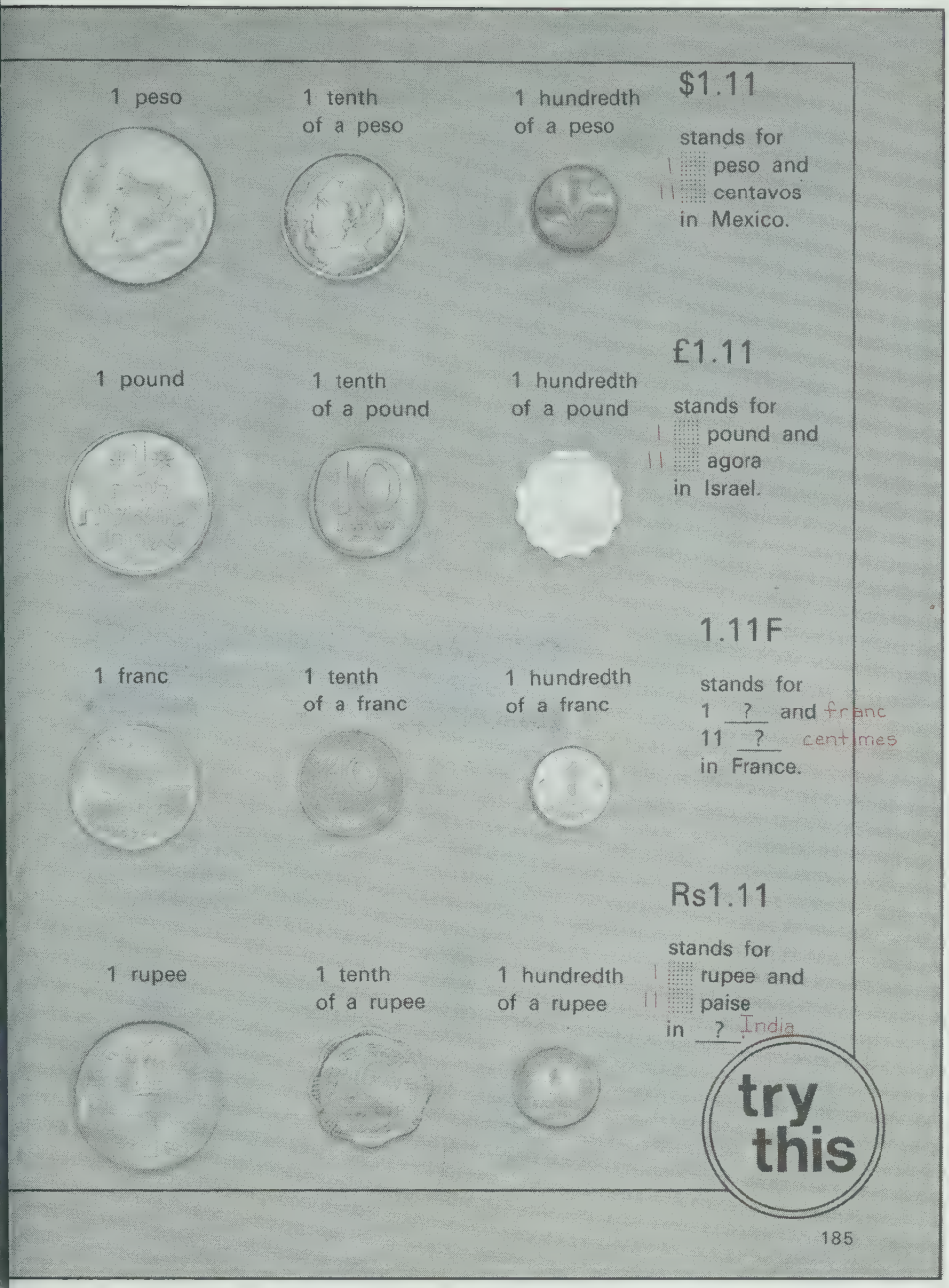
Read and interpret amounts of money in dollars and other decimal currencies



Try This: You may wish to discuss these pages with the students to enable them to share their knowledge of and experience with coins from different countries. These pages emphasize that decimals are used to show amounts of money in many countries.

Have students identify the countries for as many coins as possible. (The name of the country is not necessarily obvious for the coins in the starred exercises — 7, 8, 9, 11, and 12).

Draw attention to the different symbols shown with 1.11 ($, Руб, £, F, and Rs). Discuss that each numeral shows one (whole), one tenth, and one hundredth, or one and eleven-hundredths (dollars, rubles, and so on).



RELATED ACTIVITIES

- Some students may be able to bring coins from different countries to school for discussion and display. They may know or be able to research whether the currency of the countries concerned is based on the decimal system.
- Students may enjoy making rubbings of different coins. A coin is placed under a sheet of paper, and a crayon or pencil is rubbed on the paper so that an imprint of the coin is obtained.
- Some students may be interested in developing a set of coins and bills for a fictitious country, based on ones, tenths, and hundredths. They may design the coins and bills and give them names. This activity can reinforce the concept of decimals. The different sets may be displayed for particular amounts with the corresponding numerals.
- Some students may be interested in finding coins for multiples of hundredths and tenths in other decimal currencies; for example, 2 pence in English currency and 5 centavos in Mexican currency.

Pages 186-187

LESSON OUTCOME

Compare and order decimals from 0.00 to 19.99

Materials

copies of the unmarked number line for tenths and hundredths from page T 359 (optional), tracing paper

Prerequisite Skills

Compare and order whole numbers

Checking Prerequisite Skills

Which is greater,

1. 603 or 198? **2.** 685 or 1003?

603 1003

List from least to greatest.

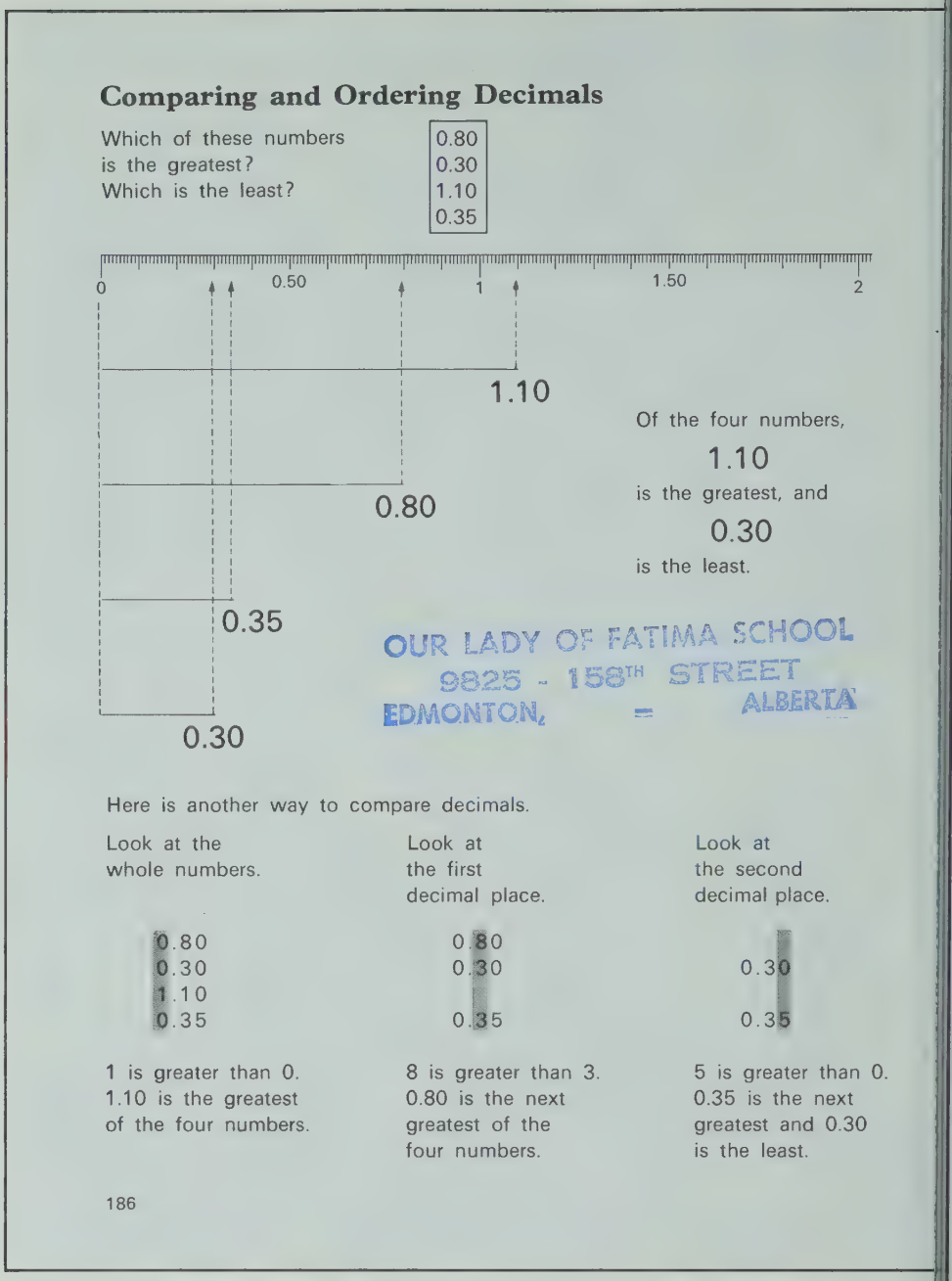
3. 427, 200, 472, 274, 1274, 742, 74

74, 200, 274, 427, 472, 742, 1274

Background

In this lesson, tenths are compared with tenths and hundredths with hundredths.

Exercises involving comparing or ordering tenths and hundredths are not encountered. For example, students are asked to compare 0.80 and 0.35, but not 0.8 and 0.35.



Comparing and Ordering Decimals

Which of these numbers is the greatest? Which is the least?

0.80
0.30
1.10
0.35

Of the four numbers,

1.10

is the greatest, and

0.30

is the least.

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Here is another way to compare decimals.

Look at the whole numbers.

0.80
0.30
1.10
0.35

1 is greater than 0. 1.10 is the greatest of the four numbers.

Look at the first decimal place.

0.80
0.30
0.35

8 is greater than 3. 0.80 is the next greatest of the four numbers.

Look at the second decimal place.

0.30
0.35

5 is greater than 0. 0.35 is the next greatest and 0.30 is the least.

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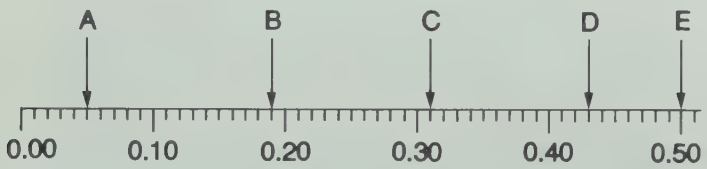
LESSON ACTIVITY

Before Using the Pages

- Draw a number line similar to the following on the board.



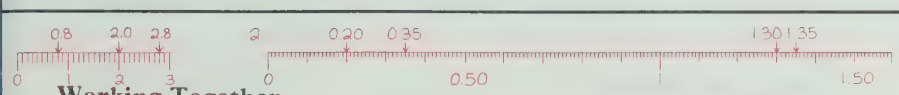
Ask questions such as,
"What is the decimal name for point C?"
"What is the decimal name for point A?"
"What is another decimal name for point E?"
"Which point names a greater number, D or E? How can you tell?"

Using the Pages

- The worked example presents two procedures by which decimals may be compared. The first involves the number line and the second involves a place-by-place analysis the digits from left to right.

Begin with a discussion of the number line to review numbers increase as you move to the right on the num line and decrease as you move to the left. For exam have the students place a finger on the point for zero then move it along the line to the point for 1. Ask, "In w direction did you move your finger?" "In what direc would you move to reach a number greater than 1?" number less than 1?" "What do you know about numbers to the right of 2?" "to the left of 2?"

Read the questions and the four numerals at the to page 186. Ask how the number line shows that 1.10 is greatest of the four numbers. Lead the students to sug that of the four numbers, 1.10 is the greatest distance f zero. Similarly, ask how the number line shows that 0.3 the least. Then name any two of the four numbers and h students state which is greater (or less) and tell why. example, $0.80 > 0.35$ since 0.80 is to the right of 0.3 the number line.



Working Together

Show each group of numbers on a number line.
Then list each group from least to greatest.

1. 2.8, 0.8, 2.0
0.8, 2.0, 2.8

2. 0.35, 1.30, 0.20, 1.35
0.20, 0.35, 1.30, 1.35

Compare the whole numbers and the digits in the decimal places. Then list each group in order

3. from least to greatest.

2.4		1.9
	12.0	2.5

1.9, 2.4, 2.5, 12.0

4. from greatest to least.

0.15		10.45
	1.74	1.04

10.45, 1.74, 1.04, 0.15

Which is greater,

5. 1.4 or 1.7? 1.7

6. 2.40 or 2.04? 2.40

Which is less,

7. 4.1 or 3.7? 3.7

8. 1.95 or 1.59? 1.59

List from least to greatest.

9. 1.68, 0.86, 1.86, 0.68
0.68, 0.86, 1.68, 1.86

List from greatest to least.

10. 2.16, 1.63, 2.36, 2.32
2.36, 2.32, 2.16, 1.63

Exercises

Which is greater,

1. 2.88 or 2.92? 2.92

2. 8.9 or 9.8? 9.8

3. $4.30 or $4.03? $4.30

Which is less,

4. 3.9 or 3.1? 3.1

5. 1.95 or 2.95? 1.95

6. $7.81 or $7.78? $7.78

List from least to greatest.

7.

1.41	1.32	1.35
0.49	0.38	

8.

5.3	3.0	3.3
3.5	0.3	

List from greatest to least.

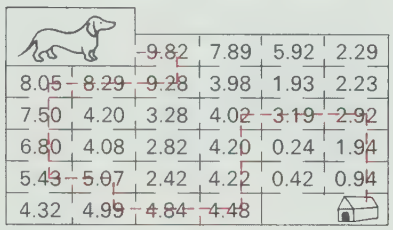
9.

1.52	2.15	3.21
3.25	10.12	

10.

$3.06	$3.12	$3.03
$3.09	$3.15	

11. Use tracing paper. Show Barky the path home, always moving to a space with a smaller number. No diagonal moves, please!



7. 0.38, 0.49, 1.32, 1.35, 1.41
8. 0.3, 3.0, 3.3, 3.5, 5.3
9. 10.12, 3.25, 3.21, 2.15, 1.52
10. $3.15, $3.12, $3.09, $3.06, $3.03

RELATED ACTIVITIES

- Provide students with a page from a catalog showing pictures of items and their prices. Have students identify the most expensive item and the least expensive item. They may compare the prices for pairs of items and then list all the prices from least to greatest or from greatest to least.
- Some students may be interested in creating a maze similar to the one in Ex. 11 on page 187 for other students to solve. It will be less demanding if more than one path is possible, and if the maze has fewer numbers than the one in Ex. 11.
- Provide students with a list of points scored by individuals in gymnastic competitions. These points are frequently given as one-place decimals and sometimes as two-place decimals. Have students order the scores to find the "gold", "silver", and "bronze" medal winners in each event.

iscuss the left-to-right procedure of inspecting the digits. An examination of the whole numbers reveals that 1.10 is the greatest number.

Emphasize that since the other three numbers have 0 wholes, it is necessary to look at the tenths' place. Afterward, it is necessary to look at the hundredths' place to compare the remaining two numbers. Emphasize that place values on the left are greatest and those on the right are least.

rking Together: For Ex. 1 and 2, students compare decimals on the number line. You may wish to give each student two copies of the unmarked number line for tenths and hundredths on page T 359. Ex. 3 and 4 emphasize the left-to-right procedure of inspecting the digits. Note that by saying, "Compare the whole numbers first", it is not necessary to discuss tens and ones individually. For example, in Ex. 3, the greatest whole number is 12 in 12.0 and the least whole number is 1 in 1.9. You may need to draw attention to the fact that the required order is least to greatest in Ex. 3 and greatest to least in Ex. 4.

When the students have finished Ex. 5-8, it would be beneficial to discuss their answers to enable them to give a reason for each choice. Some may refer to the number line and others may compare the numbers from left to right. Ask them which method they prefer and why.

Exercises: Provide each student with tracing paper for Ex. 11. When the students have found the path, you may wish to have them write the sequence of numbers that identifies the path.

Assessment

Which is greater,

1. 0.2 or 2.0? 2.0

Which is less,

2. 6.69 or 6.96? 6.69

List from least to greatest.

3. 4.80, 1.03, 2.05, 1.01, 2.67 1.01, 1.03, 2.05, 2.67, 4.80

List from greatest to least.

4. 1.8, 3.4, 12.1, 3.9, 2.0 12.1, 3.9, 3.4, 2.0, 1.8

Pages 188-189

LESSON OUTCOME

Add two one-place decimals with regrouping, sums to 9.9; add two two-place decimals with regrouping, sums to 99.99

Materials

models for 9 ones, 18 tenths, and 18 hundredths as described on page T 187 for each student, or a set of demonstration models

Prerequisite Skills

Add whole numbers with regrouping; interpret place value in two-place decimals

Checking Prerequisite Skills

Add.

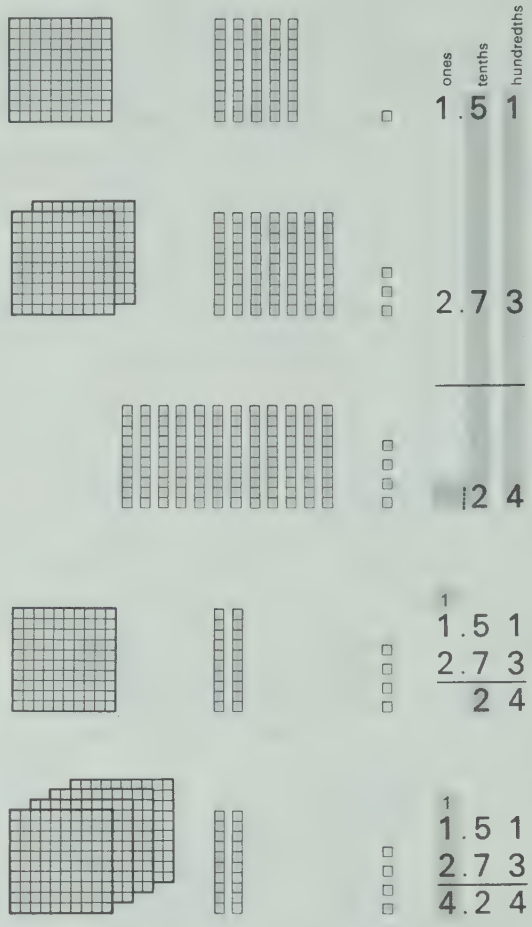
1. 47 + 65 = 112
2. 151 + 273 = 424
3. 354 + 498 = 852
4. 1678 + 935 = 2613

Complete the sentences.

5. 0.43 shows 4 tenths 3 hundredths, or 43 hundredths
6. 0.70 shows 7 tenths 0 hundredths, or 70 hundredths
7. 0.04 shows 0 tenths 4 hundredths, or 4 hundredths
8. 6.28 shows 6 ones 2 tenths 8 hundredths, or 6 and 28 hundredths

Adding Decimals

Add 1.51 and 2.73.



Show 1.51 and 2.73 with their places lined up in vertical form.

Add the hundredths and add the tenths.

Regroup 12 tenths as 1 one and 2 tenths. Show the 1 one lined up with the other ones.

Add the ones and place the decimal point.

The sum of 1.51 and 2.73 is 4.24.

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LESSON ACTIVITY

Before Using the Pages

- Use the demonstration models at the front of the class (or have each student use a set of models). Display 7 hundredths and 6 more hundredths. Ask how many hundredths there are in all. Show the model for 13 hundredths to illustrate the sum. Review that 13 hundredths can also be interpreted as 1 tenth 3 hundredths. Illustrate this by placing 1 tenth strip on the model for 13 hundredths to cover 10 hundredths. Summarize that the sum of 7 hundredths and 6 hundredths is 13 hundredths, or 1 tenth 3 hundredths. Write the exercises on the board in the first form shown below and have students help to translate it to the second, or standard, form. Discuss the similarity in adding 7 and 6 and adding 0.07 and 0.06.

7 hundredths	0.07
+ 6 hundredths	+ 0.06
13 hundredths	0.13

or 1 tenth 3 hundredths

- Use a procedure similar to the one above to develop the sum 5 tenths and 9 tenths. Show the regrouping of 10 te strips as 1 whole model. Summarize that the sum o tenths and 9 tenths is 14 tenths, or 1 and 4 tenths.

5 tenths	0.5
+ 9 tenths	+ 0.9
14 tenths	1.4

or 1 and 4 tenths

Use other examples as required.

Using the Pages

- The preliminary activities and the worked example help illustrate that the addition of decimals is similar to addition of whole numbers. The numbers are shown v their places lined up in vertical form. The addition regrouping are carried out as usual, place by place fr right to left. The only difference is that there is a deci point, without which the numerals would repres whole numbers.

Working Together

Line up the ones, tenths, and hundredths in vertical form.

1. 2.63 + 0.28
2. 3.5 + 2.7
3. 38.2 + 6.7
4. 0.40 + 40.04

Add by following the steps.

5.
$$\begin{array}{r} 5.7 \\ +\ 2.6 \end{array}$$
Add tenths and regroup.
Add ones.

6.
$$\begin{array}{r} 3.28 \\ +\ 1.04 \end{array}$$
Add hundredths and regroup.
Add tenths.
Add ones.

7.
$$\begin{array}{r} 2.65 \\ +\ 1.79 \end{array}$$
Add hundredths and regroup.
Add tenths and regroup.
Add ones.

8.
$$\begin{array}{r} 16.73 \\ +\ 34.28 \end{array}$$
Add and regroup.
Add and regroup.
Add and regroup.
Add.

Add.

9. $\begin{array}{r} 2.8 \\ +\ 3.8 \end{array}$
10. $\begin{array}{r} 4.36 \\ +\ 2.35 \end{array}$
11. $\begin{array}{r} 3.57 \\ +\ 4.79 \end{array}$
12. $\begin{array}{r} 5.93 \\ +\ 4.65 \end{array}$
13. $\begin{array}{r} 49.45 \\ +\ 32.73 \end{array}$
14. $\begin{array}{r} \$2.39 \\ +\ 6.69 \end{array}$

Exercises

Add.

1. 3.7 + 2.6
2. 1.47 + 4.45
3. 12.16 + 4.89
4. $6.81 + $0.26
5. 69.38 + 21.38
6. 9.85 + 0.91
7. 9.6 + 4.8
8. $45.46 + $6.64

9. $\begin{array}{r} 6.9 \\ +\ 1.3 \end{array}$
10. $\begin{array}{r} 3.33 \\ +\ 0.79 \end{array}$
11. $\begin{array}{r} 78.82 \\ +\ 11.62 \end{array}$
12. $\begin{array}{r} 5.27 \\ +\ 0.77 \end{array}$
13. $\begin{array}{r} 76.15 \\ +\ 7.55 \end{array}$
14. $\begin{array}{r} \$4.33 \\ +\ 5.84 \end{array}$
15. $\begin{array}{r} 4.44 \\ +\ 7.18 \end{array}$
16. $\begin{array}{r} 2.89 \\ +\ 0.75 \end{array}$
17. $\begin{array}{r} 8.1 \\ +\ 3.7 \end{array}$
18. $\begin{array}{r} 19.78 \\ +\ 20.30 \end{array}$
19. $\begin{array}{r} 1.94 \\ +\ 1.79 \end{array}$
20. $\begin{array}{r} \$0.52 \\ +\ 0.86 \end{array}$
21. $\begin{array}{r} 3.08 \\ +\ 6.34 \end{array}$
22. $\begin{array}{r} 6.27 \\ +\ 6.38 \end{array}$
23. $\begin{array}{r} 65.55 \\ +\ 2.47 \end{array}$
24. $\begin{array}{r} 9.7 \\ +\ 8.4 \end{array}$
25. $\begin{array}{r} 0.62 \\ +\ 9.39 \end{array}$
26. $\begin{array}{r} \$1.28 \\ +\ 9.85 \end{array}$

RELATED ACTIVITIES

- Have students complete exercises involving whole numbers and the corresponding exercises involving decimals.

Add.

1. $\begin{array}{r} 85 \\ +\ 67 \end{array}$
2. $\begin{array}{r} 8.5 \\ +\ 6.7 \end{array}$
3. $\begin{array}{r} 0.85 \\ +\ 0.67 \end{array}$
4. $\begin{array}{r} 126 \\ +\ 589 \end{array}$
5. $\begin{array}{r} 12.6 \\ +\ 58.9 \end{array}$
6. $\begin{array}{r} 1.26 \\ +\ 5.89 \end{array}$

Have students read the two addends involved and tell the number of ones, tenths, and hundredths for each. Have them associate the illustrations of models, the blue on the numerals, and the statement for each step in the example. Emphasize the position of the decimal point between the ones and the tenths. Point out that the dotted 1 in the addition of the tenths indicates the 10 tenths that are to be regrouped as 1 more one in the next step. Review where this extra one is shown in the ones' column.

king Together: Ex. 1-4 emphasize that lining up the places in vertical form facilitates the addition. Have the students note that lining up the decimal points helps to align the places correctly. Ex. 5-8 emphasize the right-to-left order of adding and regrouping. When the students have finished Ex. 9-14, have several of them show their work on the board and explain the procedure of adding and regrouping.

cises: Remind the students to write Ex. 1-8 in vertical form. Also, remind them to write the decimal point in each sum and the symbol $ for exercises such as Ex. 4 and 14.

Assessment

Add.

1. 4.3 + 2.9
2. 17.4 + 21.7
3. $\begin{array}{r} 21.64 \\ +\ 45.97 \end{array}$
4. $\begin{array}{r} \$2.98 \\ +\ 4.75 \end{array}$

Pages 190-191

LESSON OUTCOME

Subtract one-place decimals with regrouping, minuends to 9.9; subtract two-place decimals with regrouping, minuends to 99.99

Materials

demonstration models for ones, tenths, and hundredths, model for 0.43 as described on page T 187

Prerequisite Skills

Subtract whole numbers with regrouping; interpret place value in two-place decimals

Checking Prerequisite Skills

Subtract.

1. 362 − 237 = 125

2. 403 − 169 = 234

3. 5000 − 1438 = 3562

4. 3132 − 1453 = 1679

Complete the sentences.

5. 0.03 shows 0 tenths 3 hundredths, or 3 hundredths

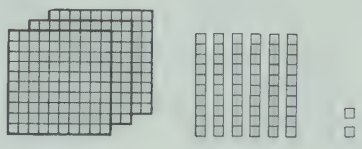
6. 0.90 shows 9 tenths 0 hundredths, or 90 hundredths

7. 0.75 shows 7 tenths 5 hundredths, or 75 hundredths

8. 3.48 shows 3 ones 4 tenths 8 hundredths, or 3 and 48 hundredths

Subtracting Decimals

Subtract 2.37 from 3.62.

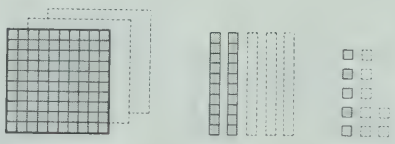


ones	tenths	hundredths	
3.	6	2	Show 3.62 and 2.37 with their places lined up. Show the greater number first.
2.	3	7	

3.	6 (5)	2 (12)	Cannot subtract 7 hundredths from 2 hundredths. Regroup 6 tenths, 2 hundredths as 5 tenths, 12 hundredths.
2.	3	7	

3.	6 (5)	2 (12)	Subtract hundredths.
2.	3	7	
		5	

3.	6 (5)	2 (12)	Subtract tenths.
2.	3	7	
	2	5	



3.	6 (5)	2 (12)	Subtract ones and place the decimal point.
2.	3	7	
1.	2	5	

2.37 subtracted from 3.62 is 1.25.

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LESSON ACTIVITY

Before Using the Pages

- Display a model for 43 hundredths on which you have placed 4 tenth strips to cover 40 of the hundredths. Ask how many tenths and how many hundredths there are and what number is shown. Summarize that 43 hundredths is the same as 4 tenths 3 hundredths. Say to the students, "I would like to subtract 9 hundredths. How can this be done if only 3 hundredths are shown?" They will likely suggest removing one of the tenth strips to show 10 more hundredths. Ask how many tenths and how many hundredths would be left after subtracting 9 hundredths.

  On the board, write the example shown on the left and have students help to translate it to the standard form as shown on the right.

3 13	3 13
~~4 3~~ hundredths	0. ~~4 3~~
− 9 hundredths	− 0. 0 9
3 4 hundredths	0. 3 4

  Discuss the similarity in subtracting 9 from 43 subtracting 0.09 from 0.43.

- Use a procedure similar to the one above to dev subtraction of tenths.

1 and 5 tenths	15 tenths	1.5
− 7 tenths	− 7 tenths	− 0.7
		0.8

  Show the regrouping of 1 whole model as 10 tenth strip make 15 tenth strips in all.

Using the Pages

- The preliminary activities and the worked example hel illustrate that subtraction of decimals requires the s procedure as subtraction of whole numbers.

  Have students read the two numbers at the top of p 190. Ask which is the greater number. Ask how m ones, tenths, and hundredths there are for each. Have students compare the illustrations of models, the blue the numerals, and the statement for each step. Point out lining up the decimal points in the two numerals lines

Working Together

Complete each subtraction.

1. 8.3 / 4.6 / 3.7	**2.** 3.90 / 1.35 / 2.55	**3.** 4.36 / 3.75 / 0.61	**4.** 4.22 / 0.53 / 3.69	**5.** 10.14 / 7.47 / 2.67	**6.** $7.04 / 3.49 / $3.55

Complete the subtraction using whole numbers.
Then complete the subtractions using decimals.

7. 65 / 28 / 37	**8.** 6.5 / 2.8 / 3.7	**9.** 0.65 / 0.28 / 0.37	**10.** $6.50 / 2.80 / $3.70

11. 532 / 374 / 158	**12.** 5.32 / 3.74 / 1.58	**13.** 53.2 / 37.4 / 15.8	**14.** 53.20 / 37.40 / 15.80	**15.** $5.32 / 3.74 / $1.58

Subtract. Add to check.

16. 9.7 / 2.8 / 6.9	**17.** 8.61 / 1.56 / 7.05	**18.** 25.32 / 4.85 / 20.47	**19.** 43.14 / 29.26 / 13.88	**20.** 2.00 / 1.86 / 0.14	**21.** $9.03 / 4.24 / $4.79

Exercises

Subtract.

1. 6.5 − 3.9 = 2.6	**2.** 3.49 − 2.53 = 0.96	**3.** 51.69 − 3.85 = 47.84	**4.** $6.81 − $4.24 = $2.57		
5. 7.45 − 2.86 = 4.59	**6.** 28.1 − 9.7 = 18.4	**7.** 5.00 − 2.68 = 2.32	**8.** $6.50 − $1.81 = $4.69		
9. 8.36 / 7.91 / 0.45	**10.** 8.6 / 3.7 / 4.9	**11.** 11.81 / 2.13 / 9.68	**12.** 79.65 / 55.94 / 23.71	**13.** 5.20 / 1.75 / 3.45	**14.** $3.16 / 1.80 / $1.36
15. 20.20 / 9.99 / 10.21	**16.** 8.00 / 6.13 / 1.87	**17.** 25.8 / 12.7 / 13.1	**18.** 8.60 / 6.06 / 2.54	**19.** 70.03 / 60.75 / 9.28	**20.** $8.95 / 3.97 / $4.98

Subtract. Add to check.

21. 7.58 / 2.41 / 5.17	**22.** 5.3 / 2.8 / 2.5	**23.** 70.00 / 45.84 / 24.16	**24.** 4.02 / 3.65 / 0.37	**25.** 32.94 / 16.47 / 16.47	**26.** $7.30 / 2.87 / $4.43

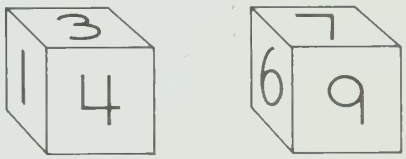
RELATED ACTIVITIES

- Some students may benefit from completing subtraction exercises on place-value charts.

ones	tenths	hundredths
	4	12
3	8	2
− 1	4	6
2	0	6

2.06

- Students may play a game using two dice, one marked with the numerals 0, 1, 2, 3, 4, 5 and the other marked 4, 5, 6, 7, 8, 9. Students take turns tossing the dice. The numbers shown may be interpreted as hundredths, tenths, or as a whole number. Each player uses the two digits he/she rolls and creates a number.



37, 73, 3.7, 7.3,
0.73, 0.37

Thereafter, numbers created from later turns are added to the previous number(s). The objective is to reach a limit previously agreed upon, for example, 40.00. The player who comes closest to this limit without exceeding the limit is the winner.

the whole numbers and the tenths and the hundredths. For the regrouping step, emphasize that 5 tenths 12 hundredths names the same number as 6 tenths 2 hundredths. After the example has been discussed, ask what numbers can be added to check the subtraction. Show the addition on the board.

Write the following exercises on the board and have students compare them with the worked example. Have students write the answers on the board and compare these with the worked example. Then have students read each exercise aloud. Emphasize that subtraction with decimals requires the same procedure as subtraction with whole numbers.

3620	362	36.2	36.20	3.62
− 2370	− 237	− 23.7	− 23.70	− 2.37

rking Together: Ex. 1-3 show the required regrouping so that the students may carry out the subtraction. For Ex. 4-6, only some of the necessary regroupings are provided so that students must continue subtracting and regrouping. These exercises provide an opportunity to discuss why the regrouping is necessary and exactly what regrouping is necessary. Ex. 7-15 emphasize that subtracting decimals is a natural extension of subtracting whole numbers. It would be beneficial to have students read completed exercises aloud. Ex. 16-21 require the students to carry out the steps of subtraction without assistance. However, they are also required to check each subtraction by using addition.

Exercises: Remind the students to show Ex. 1-8 in vertical form and to write the symbol $ in answers where necessary.

Assessment

Subtract.

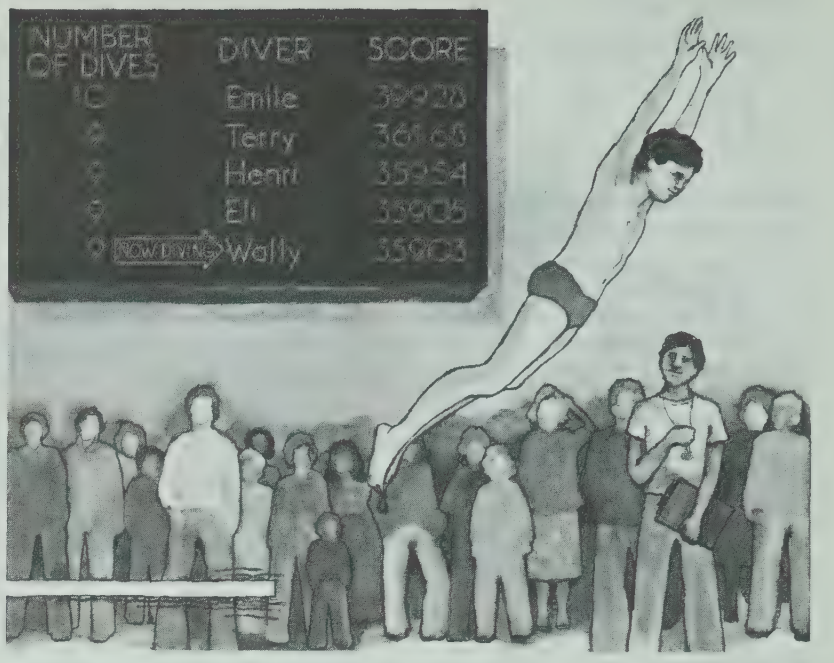
1. 8.3 − 2.5 = 5.8	**2.** 67.1 − 32.9 = 34.2
3. $3.02 / 1.98 / $1.04	**4.** 60.00 / 23.95 / 36.05

Pages 192-193

OBJECTIVE

Demonstrate competence in adding and subtracting decimals with regrouping; solve related word problems

Practice



Wally had trouble on his tenth and final dive.

1. Wally scored 29.52 on this dive. What was Wally's total score after 10 dives? 388.55
2. Eli scored 42.06 on his tenth dive. What was Eli's total score after 10 dives? 401.11
3. Henri scored 41.52 on his tenth dive. What was Henri's total score after 10 dives? 401.06
4. Terry scored 39.27 on his tenth dive. What was Terry's total score after 10 dives? 400.95
5. Emile had scored 41.30 on his tenth dive. What was Emile's score after 9 dives? 357.98
*6. Draw a picture of the scoreboard after 10 dives. Show the divers listed in order from high scorer to low scorer.
*7. Who had the better final score, Emile or Henri? Henri How much better? 1.78
*8. By how many points did Eli finish ahead of each of the other divers? Henri, 0.05; Terry, 0.16; Emile, 1.83; Wally, 12.56

6.

Number of Dives	Diver	Score
10	Eli	401.11
10	Henri	401.06
10	Terry	400.95
10	Emile	399.28
10	Wally	388.55

LESSON ACTIVITY

Using the Pages

- Begin with a discussion of the illustration. Ask what action is shown. If some of the students in your class have competed in swimming events, encourage them to share their experiences and knowledge with the other students.

  Ask questions about the scoreboard at the top of page 192; for example, "How many dives has Terry completed?" "What is Terry's score after nine dives?" Read the statement under the illustration. Some students may be able to suggest the kinds of difficulty Wally encountered on his tenth dive.

  Draw the student's attention to the chart at the top of page 193. Discuss that tickets are sold to enable interested people to watch competitive events. Ask which section has the most expensive tickets and which has the least expensive tickets. Ask what the price is for a student ticket in the blue section.

- These exercises involve determining whether addition subtraction is needed to solve a particular problem. F starred exercises, it may be necessary to use informati derived in earlier problems (Ex. 6-8), there may be mo than one step required to solve the problem (Ex. 8), or th may be more than one answer (Ex. 14 and 15). Provide opportunity for the students to discuss Ex. 15.

  You may wish to develop the solution to Ex. 1 on t board with the students. Review that for the solution, t addition or subtraction should be shown (except for Ex. and 15) and a concluding statement written.

Keeping Sharp: These exercises help to maintain the skills multiplication with multiples of 10 and multiples of 100 factors. Ex. 1-6 emphasize the application of basic facts multiplying. The basic facts will be applied again in t following lesson in multiplying decimal tenths and wh numbers.

This chart shows ticket prices for the diving meet.

Section \ Age	Adult	Student	Child
Gold	$2.25	$1.50	$0.75
Blue	$1.75	$1.25	$0.50
Red	$1.25	$0.90	$0.25

9. Eli's parents sat in Blue seats. How much did their two tickets cost? $3.50

10. Henri's brother bought an adult Gold and his sister bought a student Gold. How much did their tickets cost? $3.75

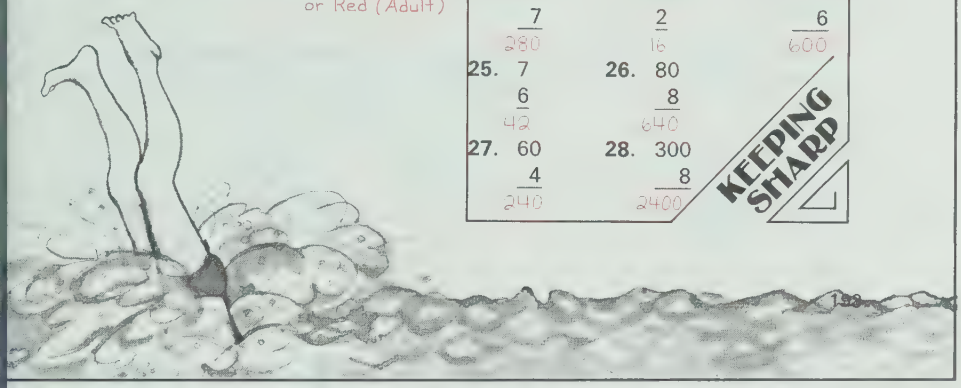
11. What was the total cost for three Blue tickets, one in each age group? $3.50

12. What was the total cost for three adult's seats, one in each section? $5.25

13. How much more did an adult Red cost than a student Red? $0.35

***14.** How much more did it cost to sit in a Blue seat than in a Red seat? Adult $0.50, Student $0.35, Child $0.25

***15.** Suzie had $1.25. In which section did she sit? Blue (Student) or Red (Adult)



Multiply to complete each pattern.

1. $3 \times 2 = 6$ **2.** $2 \times 4 = 8$
$3 \times 20 = 60$ $2 \times 40 = 80$
$3 \times 200 = 600$ $2 \times 400 = 800$

3. $5 \times 3 = 15$ **4.** $3 \times 7 = 21$
$5 \times 30 = 150$ $3 \times 70 = 210$
$5 \times 300 = 1500$ $3 \times 700 = 2100$

5.

1	10	100
7	7	7
7	70	700

6.

6	60	600
8	8	8
48	480	4800

Multiply.

7. 4 × 4 = 16	**8.** 30 × 2 = 60	**9.** 200 × 6 = 1200
10. 5 × 8 = 40	**11.** 90 × 6 = 540	**12.** 900 × 8 = 7200
13. 500 × 3 = 1500	**14.** 800 × 4 = 3200	**15.** 70 × 9 = 630
16. 400 × 9 = 3600	**17.** 6 × 1 = 6	**18.** 700 × 2 = 1400
19. 50 × 6 = 300	**20.** 600 × 5 = 3000	**21.** 10 × 4 = 40
22. 40 × 7 = 280	**23.** 8 × 2 = 16	**24.** 100 × 6 = 600
25. 7 × 6 = 42	**26.** 80 × 8 = 640	
27. 60 × 4 = 240	**28.** 300 × 8 = 2400	

KEEPING SHARP

RELATED ACTIVITIES

- Have students work at one or more of the activities suggested in *Related Activities* of Unit 5 for further review and practice with multiplication.
- Adapt the second activity in *Related Activities* on page T205 for subtraction. Have the students begin with a number such as 25.00 and subtract numbers for successive rolls of the dice. The player who comes closest to zero is the winner.

Pages 194-195

LESSON OUTCOME

Multiply a one-place decimal to 0.9 by a whole number less than 10

Materials

models for ones and tenths

Prerequisite Skills

Complete basic multiplication facts

Checking Prerequisite Skills

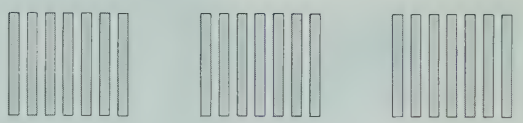
Multiply.

1. 7 × 3 = 21	**2.** 6 × 4 = 24	**3.** 5 × 5 = 25
4. 8 × 9 = 72	**5.** 3 × 8 = 24	**6.** 9 × 5 = 45

Multiplying Decimal Tenths and Whole Numbers

Multiply 3 and 0.7.

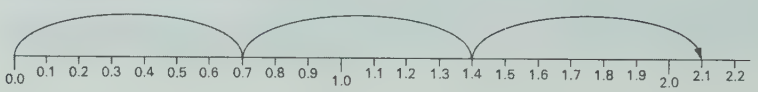
For 3 × 0.7, think of 3 groups of 7 tenths.



3 groups of 7 tenths equal 21 tenths, or 2 ones and 1 tenth.

3 × 0.7 = 2.1

On a number line, 3 × 0.7 looks like this:



3 × 0.7 = 2.1

Working Together

Complete each multiplication.

1. 3 × 2 = ▢ 6
3 × 2 tenths = ▢ 6 tenths
3 × 0.2 = ▢ 0.6

2. 4 × 6 = ▢ 24
4 × 6 tenths = ▢ 24 tenths or ▢ 2 ones ▢ 4 tenths
4 × 0.6 = ▢ 2.4

3. 4 × 2 = 8 ▢
4 tenths × 2 = 8 ▢ tenths
0.4 × 2 = 0.8 ▢

4. 7 × 3 = 21 ▢
7 tenths × 3 = 21 ▢ tenths or ▢ 2 ones ▢ 1 tenth
0.7 × 3 = 2.1 ▢

194

LESSON ACTIVITY

Before Using the Pages

- Spend a few moments reviewing the regrouping of tenths as ones. For example, display 16 tenths and ask how many tenths there are. Ask for a simpler way to represent the number shown. Have a student regroup 10 tenths as 1 one. Summarize that 16 tenths names the same number as 1 and 6 tenths. Write the sentence 16 tenths = 1.6 on the board. Develop other similar exercises on the board, using the models if necessary. Four examples are given below.

  14 tenths = _____
  20 tenths = _____
  35 tenths = _____
  24 tenths = _____

- Review that 3 × 7 = 21 is a shorter way of thinking of 3 groups of 7, the sum 7 + 7 + 7, or 3 jumps of 7 on the number line. Ask what meaning might be given to the number phrase 3 × 0.7. Have a few students show their ideas on the board.

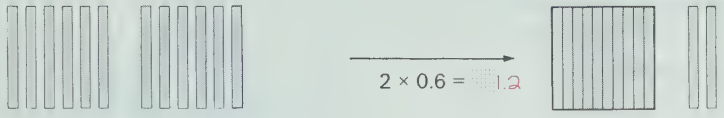
Using the Pages

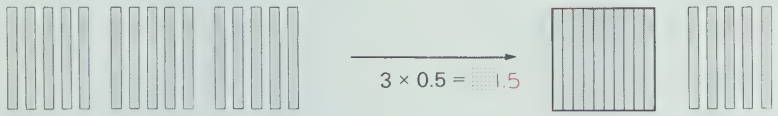
- The worked example applies to decimal tenths the concept multiplication as showing equal groups and taking equ jumps on the number line. Ask questions such as,
  "How many groups are there?"
  "How many tenths are in each group?"
  "How many tenths are there in all?"
  "What is a simpler way to show twenty-one tenths?"
  "What is the product of three and seven-tenths?"
  Discuss how the product is found on the number line starting at zero and taking 3 jumps of 7 tenths. Discuss ho knowing 3 × 7 = 21 helps in finding 3 × 0.7 = 2.1.

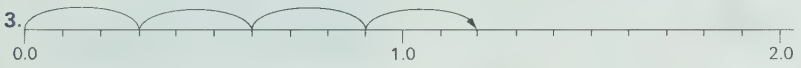
Working Together: These exercises emphasize using bas facts to help multiply decimal tenths. The relationship seen more clearly through the second step in each exercis for example, 3 × 2 tenths = 6 tenths in Ex. 1. Us other exercises similar to the ones given to hel students develop the thought process. Note that thes exercises include both the horizontal form and the vertic

Exercises

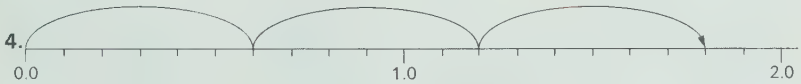
Complete the multiplication sentence for each picture.

1. 

2. 

3. 

4 × 0.3 = 1.2

4. 

3 × 0.6 = 1.8

Complete each pair of multiplications.

5. 3 × 0.3 = 0.9; 2 × 0.3 = 0.6
6. 4 × 0.4 = 1.6; 4 × 0.4 = 1.6
7. 4 × 0.4 = 1.6; 5 × 0.4 = 2.0
8. 5 × 0.5 = 2.5; 5 × 0.5 = 2.5
9. 7 × 0.7 = 4.9; 6 × 0.7 = 4.2
10. 3 × 0.3 = 0.9; 8 × 0.3 = 2.4

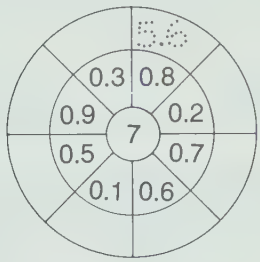
Multiply.

11. 3 × 0.3 = 0.9
12. 2 × 0.7 = 1.4
13. 6 × 0.9 = 5.4
14. 7 × 0.6 = 4.2
15. 4 × 0.2 = 0.8
16. 4 × 0.5 = 2.0
17. 5 × 0.6 = 3.0
18. 8 × 0.9 = 7.2

19. 0.8 × 3 = 2.4
20. 0.5 × 6 = 3.0
21. 0.2 × 6 = 1.2
22. 0.3 × 5 = 1.5
23. 0.7 × 7 = 4.9
24. 0.4 × 7 = 2.8
25. 0.7 × 5 = 3.5
26. 0.8 × 7 = 5.6
27. 0.2 × 9 = 1.8
28. 0.8 × 6 = 4.8
29. 0.7 × 9 = 6.3
30. 0.9 × 5 = 4.5

RELATED ACTIVITIES

- Prepare number wheels and multiplication tables for the students to complete, using copies of page T360.



×	0.8
1	
2	
3	2.4
4	
5	
6	
7	
8	
9	

×	0.4
6	2.4
	1.2
	2.8
9	
1	
	0.8
	1.6
5	
	3.2

- Adapt the second activity in *Related Activities* on page T 115 for multiplying decimal tenths by a whole number.

$$\begin{array}{r} 3 \\ \times\ 6 \\ \hline 18 \end{array} \qquad \begin{array}{r} 0.3 \\ \times\ 6 \\ \hline 1.8 \end{array}$$

- Have students complete patterns in multiplication in a sequence of exercises such as the following.

$$\begin{array}{r} 300 \\ \times\ 6 \end{array} \qquad \begin{array}{r} 30 \\ \times\ 6 \end{array} \qquad \begin{array}{r} 3 \\ \times\ 6 \end{array} \qquad \begin{array}{r} 0.3 \\ \times\ 6 \end{array}$$

form for multiplication. You may wish to have students demonstrate the multiplication for Ex. 1-3 with models, and show Ex. 1 and 3 by tracing with their fingers on the number line on page 194.

ercises: You may wish to assign these exercises in two parts as follows. Assign Ex. 1-4. Have students interpret the illustrations orally. Then discuss the results when they have completed the sentences. These exercises help students to review the meaning of multiplication as showing equal groups and taking equal jumps on the number line.

Assign Ex. 5-30 as independent work. Ex. 5-10 encourage students to think of basic facts when multiplying decimal tenths. It would be helpful to have the students discuss Ex. 11-30 when they have finished. For example, for Ex. 12, a student may say, "Since two times seven equals fourteen, then two times seven-tenths equals fourteen-tenths, or one and four-tenths."

Assessment

Complete each pair of multiplications.

1. 4 × 0.4 = 1.6; 5 × 0.4 = 2.0
2. 6 × 0.6 = 3.6; 8 × 0.6 = 4.8

Multiply.

3. 0.7 × 9 = 6.3
4. 0.8 × 3 = 2.4
5. 8 × 0.8 = 6.4
6. 2 × 0.9 = 1.8

LESSON OUTCOME

Multiply a one-place decimal to 9.9 by a whole number less than 10, using the standard form

Materials

models for ones and tenths (optional)

Prerequisite Skills

Use the standard algorithm to multiply a two-digit number by a one-digit number

Checking Prerequisite Skills

Multiply.

1. 17 × 5 = 85

2. 85 × 4 = 340

3. 14 × 3 = 42

4. 58 × 6 = 348

Multiplying One-Place Decimals

Mike walks 1.7 km between school and home each day. How far does he walk between school and home in 5 school days?

Multiply 5 and 1.7.

Here is a long form for multiplying.

Here is a short form or standard form for multiplying.

$$\begin{array}{r} 1.7 \\ \times\ 5 \\ \hline 3.5 \end{array}$$

5 × 7 tenths = 35 tenths or 3 ones and 5 tenths.

$$\begin{array}{r} {\scriptstyle 3} \\ 1.7 \\ \times\ 5 \\ \hline .5 \end{array}$$

$$\begin{array}{r} 1.7 \\ \times\ 5 \\ \hline 3.5 \\ 5.0 \end{array}$$

5 × 1 = 5

and 3 more are 8.

$$\begin{array}{r} {\scriptstyle 3} \\ 1.7 \\ \times\ 5 \\ \hline 8.5 \end{array}$$

Done!

$$\begin{array}{r} 1.7 \\ \times\ 5 \\ \hline 3.5 \\ 5.0 \\ \hline 8.5 \end{array}$$

Add.

Mike walks 8.5 km between school and home in 5 school days.

If Mike walks 8.5 km between school and home in a week, how far would he walk in 4 weeks?

Use the short form to multiply 4 and 8.5.

For $\begin{array}{r} 8.5 \\ \times\ 4 \\ \hline \end{array}$ multiply tenths first, $\begin{array}{r} {\scriptstyle 2} \\ 8.5 \\ \times\ 4 \\ \hline .0 \end{array}$ and then multiply ones. $\begin{array}{r} {\scriptstyle 2} \\ 8.5 \\ \times\ 4 \\ \hline 34.0 \end{array}$

Mike would walk 34 km in 4 weeks.

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LESSON ACTIVITY

Before Using the Pages

- Write on the board a few exercises similar to the following to review the work of the previous lesson. Have the students complete the exercises. Then have a few students explain the procedure and complete the exercises on the board.

$$\begin{array}{r} 0.7 \\ \times\ 5 \\ \hline \end{array} \qquad \begin{array}{r} 0.5 \\ \times\ 4 \\ \hline \end{array}$$

$$\begin{array}{r} 0.4 \\ \times\ 3 \\ \hline \end{array} \qquad \begin{array}{r} 0.8 \\ \times\ 6 \\ \hline \end{array}$$

Write the exercise 3 × 2.4 in vertical form on the board and have students suggest procedures that might be used to find the product. Have them demonstrate their ideas on the board and obtain suggestions from the other students. Some suggestions might be to use repeated addition, to use models of ones and tenths and form three equal groups, or to multiply as for whole numbers and place the decimal point in the product.

Using the Pages

- The worked example shows the long form and the short, standard, form for multiplying 1.7 and 5. The blue on t numerals draws attention to important features for discu sion in each step. Read the word problem at the top of pa 196. Question the students to lead them to contrast ea step of the two solutions, in turn. For example, the digit for 3 ones is shown in different positions, although each aligned with the ones' place. Review that showing the ones above the 1 one in the standard form makes a short written solution possible.

A second example of the standard form is provided at t bottom of page 196. Ask questions to review the steps the procedure; for example,

"What two numbers are to be multiplied?"

"What is multiplied first?"

"How is twenty-tenths shown?"

"How is thirty-four obtained in the product?"

Some students may need to use models of ones a tenths to help understand the procedure.

Working Together

Complete each multiplication.

1. 14 × 3 = 42 — 14 tenths × 3 = 42 tenths — 1.4 × 3 = 4.2

2. 58 × 6 = 348 — 58 tenths × 6 = 348 tenths — 5.8 × 6 = 34.8

Multiply.

3. 4.3 × 2 = 8.6

4. 3.6 × 7 = 25.2

5. 7.5 × 8 = 60.0

Exercises

Complete each pair of multiplications.

1. 23 × 4 = 92 — 2.3 × 4 = 9.2

2. 58 × 9 = 522 — 5.8 × 9 = 52.2

3. 64 × 5 = 320 — 6.4 × 5 = 32.0

Multiply.

4. 3 × 2.6 = 7.8

5. 5 × 5.8 = 29.0

6. 6 × 4.2 = 25.2

7. 8 × 6.9 = 55.2

8. 7.5 × 2 = 15.0

9. 3.7 × 9 = 33.3

10. 8.3 × 8 = 66.4

11. 9.5 × 3 = 28.5

12. 4.6 × 9 = 41.4

13. 2.1 × 8 = 16.8

14. 9.6 × 6 = 57.6

15. 5.4 × 7 = 37.8

16. 6.9 × 4 = 27.6

17. 2.8 × 2 = 5.6

18. 3.7 × 6 = 22.2

19. 7.9 × 7 = 55.3

What would the calculator show for each?

20. 9.3 ⊠ 5 = 46.5

21. 4.7 ⊞ 5.6 = 10.3

22. 10.2 ⊟ 7.5 = 2.7

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RELATED ACTIVITIES

- Have students complete patterns in multiplication in sequences of exercises similar to the following.

420 × 3	42 × 3	4.2 × 3
390 × 6	39 × 6	3.9 × 6

- Some students may benefit by completing exercises similar to the following.

1.4 = _____ tenths

_____ = 35 tenths

6.3 = _____ tenths

_____ = 40 tenths

- Students who are familiar with the relationship between metres and kilometres may be able to determine the distance walked between school and home in one day (or some other reasonable distance walked in one day). They may then use multiplication to find the distance walked in five school days.

orking Together: Ex. 1 and 2 emphasize that multiplication with decimals requires the same procedure as multiplication with whole numbers. Understanding that 1.4, or 1 and 4 tenths, for example, is the same as 14 tenths helps students to relate the multiplication 3 × 1.4 to the multiplication 3 × 14 (Ex. 1). Use other similar exercises to help students understand the procedure.

When the students have completed Ex. 3-5, have three of them explain their work and show the exercises on the board. For example, for Ex. 3, 4.3 is thought of as 43 tenths, the multiplication is carried out as for whole numbers, the product is thought of as 86 tenths, and is then interpreted as 8 ones and 6 tenths by placing the decimal point between the 8 and the 6.

ercises: Remind the students to show Ex. 4-7 in vertical form. Some students may benefit from reading several completed exercises aloud.

Assessment

Complete each pair of multiplications.

1. 42 × 3 = 126 — 4.2 × 3 = 12.6

2. 85 × 9 = 765 — 8.5 × 9 = 76.5

Multiply.

3. 6.7 × 4 = 26.8

4. 8.2 × 5 = 41.0

5. 3.9 × 8 = 31.2

Pages 198-199

LESSON OUTCOME

Round one-place decimals to 19.9 to the nearest whole number

Prerequisite Skills

Interpret place value in one-place decimals

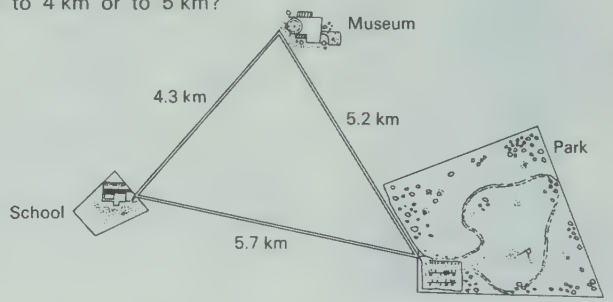
Checking Prerequisite Skills

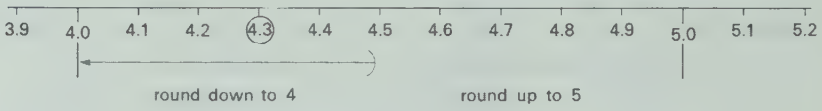
Copy and complete the chart.

		ones	tenths	
1.	3.4	?3	? 4	
2.	0.8	?0	? 8	
3.	?	9	5	9.5
4.	?	4	2	4.2

Rounding Decimal Tenths to Whole Numbers

The distance from the school to the museum is between 4 km and 5 km. Is it closer to 4 km or to 5 km?



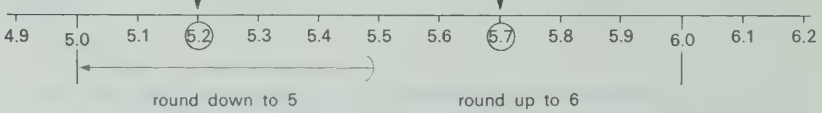


4.3 rounded to the nearest whole number is 4.

The distance from the school to the museum is 4 km to the nearest whole number of kilometres.

The distance from the museum to the park is between 5 km and 6 km.

The distance from the park to the school is between 5 km and 6 km.



5.2 rounded to the nearest whole number is 5.

5.7 rounded to the nearest whole number is 6.

The distance from the museum to the park is 5 km to the nearest whole number of kilometres.

The distance from the park to the school is 6 km to the nearest whole number of kilometres.

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LESSON ACTIVITY

Before Using the Pages

- Spend a few moments reviewing the concept of rounding whole numbers to the nearest ten. For example, have each of several students name a whole number between 40 and 50. Ask each student whether her/his number is closer to 40 or to 50. Have students recall the terminology "rounded to the nearest ten" and use it to describe their answers. Discuss a number such as 45 and lead the students to recall that it would be "rounded up" to 50, to the nearest ten. If necessary, refer to a number line to help students recall the procedure. Vary the activity by naming a number and having students round the number to the nearest ten, describing how they arrived at their answer. Suggest that just as whole numbers can be rounded to the nearest ten, decimal tenths can be rounded to the nearest whole number.

Using the Pages

- The illustration presents a situation in which rounding decim tenths might occur naturally. Ask questions such as, "What is the distance from the school to the museum?" "Which two places are five and seven-tenths kilometr apart?"
"Is the distance greater from the park to the museum from the park to the school?" "How much greater?"

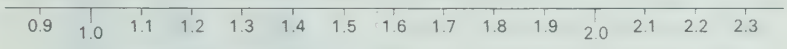
  Have a student read the word problem at the top of pag 198. Ask how the number line helps to show whether 4.3 closer to 4 or to 5. (You may need to review that 4 nam the same number as 4.0, and 5 as 5.0.) Discuss th significance of the red and blue arrows for the number lin Ask what is special about 4.5 (it is the same distance from as from 5) and ask whether 4.5 should be rounded up to 5 down to 4. It may be compared with rounding 45 up to 5 in *Before Using the Pages*.

RELATED ACTIVITIES

- A small group of students may play the game "Round It" described on page T345.

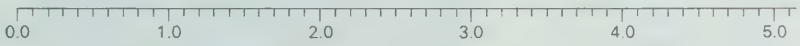
Working Together

Use number lines to help you answer the questions.



1. 1.3 is between 1 and 2. Is it closer to 1 or to 2? 1

2. 1.6 is between 1 and 2. Is it closer to 1 or to 2? 2



3. 3.2 is between which two whole numbers? 3 and 4

4. 1.5 is between which two whole numbers? 1 and 2

5. 9.6 is between which two whole numbers? 9 and 10

Name the first whole number you find on each side of 3.2.

Round each of these to the nearest whole number.

6. 3.2 3 7. 1.5 2 8. 9.6 10

Exercises

Round each of these to the nearest whole number.

1. 2.7 3 2. 7.1 7 3. 0.8
4. 3.5 4 5. 9.7 10 6. 12.2 12

Round each of these to the nearest whole number of litres, kilometres, or kilograms.

7. 7.8 L 8 L 8. 5.3 km 5 km 9. 3.6 kg 4 kg
10. 5.9 km 6 km 11. 2.5 kg 3 kg 12. 8.4 L 8 L
13. 6.1 kg 6 kg 14. 14.6 L 15 L 15. 9.5 km 10 km

Write each sentence showing each amount rounded.

16. She carried 8.9 kg on her back.
17. They drank 6.5 L of milk.
18. The children traveled 15.2 km.

16 She carried 9 kg on her back
17. They drank 7 L of milk
18 The children traveled 15 km

Answer each question with a whole number.

1. How many pieces of string that are 1 m long can be cut from a piece of string that is 4.5 m long? 4
2. The cookies are sold two for 9¢. How much would one cookie cost? 5¢
3. 4.5 pies were left after the picnic. Each box held one pie. How many boxes were needed to carry the pies home? 5
4. The jug holds 4.5 L. Each can of juice holds 1 L. How many cans must be opened to fill the jug? 5
5. The pail holds 4.5 L. Each bottle holds 1 L. How many bottles can be filled from the pail? 4

PROBLEM SOLVING

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Discuss the rest of the example in a similar manner, summarizing each step by having students read the statements.

orking Together: For Ex. 1 and 2, the upper and lower whole number limits are named. This enables you to determine whether students can identify if the lower limit or the upper limit is the correct choice for rounding the decimal tenth. To assist with this, a number line is provided. Use other similar exercises as needed before assigning Ex. 3-5. These deal with the skill of naming the upper and lower whole number limits. For assistance, students can apply the suggestion given in the "thought cloud" and refer to the number line. Note that the same decimals are involved in Ex. 6-8 as in Ex. 3-5. Because of this, the answer to Ex. 3 helps in answering Ex. 6, for example.

Exercises: You may wish to review the meaning of the symbols L, km, and kg, which appear in Ex. 7-18.

Problem Solving: In certain everyday situations, the rounding of numbers up or down does not make sense. Some of these situations are presented at this time and can motivate a discussion as to whether rounding up or rounding down is preferable in each case.

Assessment

Round each of these to the nearest whole number.

1. 7.2 7 2. 9.6 10 3. 0.7 1 4. 8.5 9 5. 16.3 16

Page 200

LESSON OUTCOME

Round one-place decimal addends with two or three digits to estimate the sum

Vocabulary

estimate

Prerequisite Skills

Round decimal tenths to the nearest whole number

Checking Prerequisite Skills

Round to the nearest whole number.

1. 0.8 1 **2.** 3.2 3

3. 6.5 7 **4.** 9.9 10

RELATED ACTIVITIES

- Have students round the addends and estimate the sums for the following exercises on page 189: Ex. 2, 5, and 9 of *Working Together*; Ex. 1, 7, 9, 17, and 24 of *Exercises*. Afterward, they may compare the estimates of the sums with the exact sums from their earlier work.

Rounding Addends to Estimate the Sum

Ernst carried 8.9 kg on his back. Shelly carried 7.4 kg and Kelly carried 9.8 kg. Estimate the total mass of the backpacks.

Round each mass to the nearest whole number of kilograms.

8.9 → 9
7.4 → 7
9.8 → 10
Find the sum. → 26

The total mass of the backpacks is about 26 kg.

Working Together

Make a choice to estimate each sum. Then add to get the estimate.

1. 2.9 / 8.1 — 2 / 8 or 3 / 8 (11) or 3 / 9

2. 6.3 / 3.1 — 6 / 3 (9) or 6 / 4 or 7 / 4

3. 17.3 / 8.5 — 17 / 8 or 17 / 9 (26) or 18 / 9

4. 5.9 / 8.7 — 5 / 8 or 5 / 9 or 6 / 9 (15)

Exercises

Round each addend to the nearest whole number. Then add to estimate each sum.

1. 1.9 2 / 4.3 4 / 6

2. 4.0 4 / 2.4 2 / 6

3. 3.2 3 / 2.8 3 / 6

4. 5.6 6 / 1.9 2 / 8

5. 7.3 7 / 3.6 4 / 11

6. 6.5 7 / 8.4 8 / 15

7. 3.9 4 / 7.3 7 / 10.5 11 / 22

8. 10.4 10 / 4.9 5 / 9.9 10 / 25

9. 1.2 1 / 1.9 2 / 2.2 2 / 5

Round each amount to the nearest whole number. Then add to estimate the total amount.

10. 2.2 kg and 3.1 kg 2 kg and 3 kg; 5 kg

11. 5.7 L and 1.4 L 6 L and 1 L; 7 L

12. 4.1 km and 4.8 km 4 km and 5 km; 9 km

13. 3.9 L and 5.9 L 4 L and 6 L; 10 L

14. 2.4 km and 7.5 km 2 km and 8 km; 10 km

15. 8.6 kg and 6.0 kg 9 kg and 6 kg; 15 kg

16. 4.7 L, 1.6 L, and 3.3 L 5 L, 2 L, and 3 L; 1

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LESSON ACTIVITY

Using the Page

- Suggest that rounding decimal tenths to the nearest whole number is helpful in estimating a sum. The situation described in the worked example suggests an instance for which an estimate of a sum is a satisfactory answer.

  Read the problem that introduces the illustration. Have students explain the rounding of each addend. They will likely agree that it is easier to find the sum of 9, 7, and 10 than the sum of 8.9, 7.4, and 9.8. Summarize that the exact sum is close to 26. If you wish, have the students find the exact sum and compare it with 26. Emphasize the word *about* in reading the concluding statement.

Working Together: These exercises examine the skill of rounding decimal tenths to the nearest whole number. Have students give reasons for their choice in each exercise.

Exercises: Remind the students to write the appropriate unit of measurement for each estimate in Ex. 10-16.

Assessment

Round each addend to the nearest whole number. Then add to estimate each sum.

1. 6.3 6 / 2.8 3 / 9

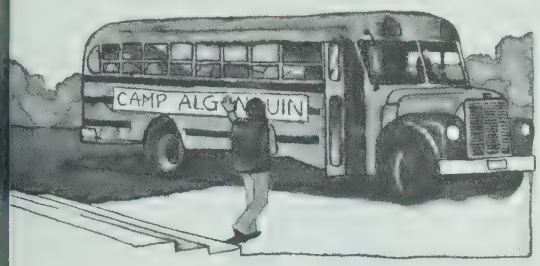
2. 4.9 5 / 3.8 4 / 9

3. 8.1 8 / 7.4 7 / 15

4. 1.3 1 / 3.7 4 / 1.1 1 / 6

Rounding Factors to Estimate the Product

The bus uses 12.8 L of fuel for each trip to camp. Estimate the number of litres needed for 5 trips to camp.



Round to the nearest whole number of litres.

12.8 → 13

5

Find the product. → 65

The bus will need about 65 L of fuel.

Working Together

Make a choice to estimate each product. Then multiply to get the estimate.

1. 3.9 × 4 — 3 × 4 or 4 × 4 = 16

2. 12.4 × 3 — 12 × 3 = 36 or 13 × 3

Round to the nearest whole number and multiply.

3. 7.4 → 7 × 3 = 21

4. 3.9 → 4 × 2 = 8

5. 11.8 → 12 × 4 = 48

Exercises

Round to the nearest whole number and multiply.

1. 2.7 → 3 × 4 = 12

2. 1.8 → 2 × 3 = 6

3. 3.3 → 3 × 2 = 6

4. 2.4 → 2 × 3 = 6

5. 3.6 → 4 × 4 = 16

6. 26.1 → 26 × 2 = 52

7. 13.3 → 13 × 8 = 104

8. 11.9 → 12 × 5 = 60

9. 24.1 → 24 × 4 = 96

10. 15.8 → 16 × 3 = 48

Estimate the total amount.

11. 4 backpacks, 6.9 kg in each 28 kg

12. 4 trips, 14.2 L of fuel for each trip 56 L

201

Page 201

LESSON OUTCOME

Round one-place decimal factors with two or three digits to estimate a product

Prerequisite Skills

Round decimal tenths to the nearest whole number; multiply a whole number by a whole number less than 10

Checking Prerequisite Skills

Round to the nearest whole number.

1. 4.1 4 **2.** 6.9 7 **3.** 11.7 12

Multiply.

4. 26 × 2 = 52 **5.** 13 × 8 = 104 **6.** 15 × 3 = 45

RELATED ACTIVITIES

- Have students round the decimal factor to the nearest whole number and estimate the products for Ex. 4-19 on page 197. Afterward, they may compare the estimates of the products with the exact products from their earlier work.

SSON ACTIVITY

ng the Page

ecall that in the previous lesson, decimal tenths were rounded to the nearest whole number to help in estimating sums. Have a student read the title at the top of page 201 to introduce this lesson. Read the word problem. Discuss that the solution involves multiplication because there are five groups of 12.8 (5 trips, each requiring 12.8 L of fuel). Ask what number may be rounded to help estimate the product. Discuss why 12.8 is rounded up. Have a student explain the multiplication 5 × 13. Emphasize the word *about* in the concluding statement. Summarize that 65 is an estimate of the number of litres of fuel needed for 5 trips to camp.

rking Together: Ex. 1 and 2 deal with the skill of rounding decimal tenths. Have students explain their choices. For Ex. 3-5, the students apply this skill and estimate the products.

Exercises: Some students will likely be able to perform the rounding and multiplication for Ex. 1-5 mentally and write only the estimate of each product.

Assessment

Round to the nearest whole number and multiply.

1. 8.7 → 9 × 2 = 18 **2.** 5.2 → 5 × 6 = 30 **3.** 13.9 → 14 × 4 = 56 **4.** 24.4 → 24 × 5 = 120

Page 202

OBJECTIVE

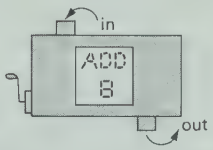
Use a trial-and-error approach to find the correct answer

RELATED ACTIVITIES

- Some students may enjoy creating "machines" and making tables for other students to guess what each machine does, and then test each of their guesses.

Guess and Test

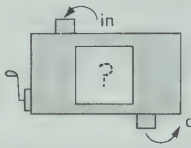
This machine adds 8 to each number that goes in.



in	3	5	8	0	7	6
out	11	13	16	8	15	14

Guess what each machine does. Test your guess with all the numbers in the table.

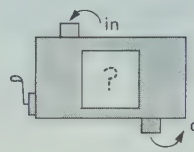
1.



subtracts 10

in	15	12	18	10	22	35
out	5	2	8	0	12	25

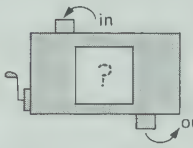
2.



multiplies by 7

in	3	7	0	5	2	10
out	21	49	0	35	14	70

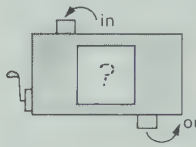
3.



adds 0.6

in	0.3	0.6	1.2	2.4	3.0	0.5
out	0.9	1.2	1.8	3.0	3.6	1.1

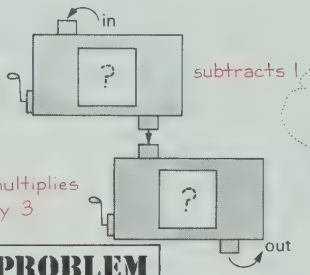
4.



divides by 3

in	15	18	12	6	60	21
out	5	6	4	2	20	7

5.



Two things happen to each number that goes in. Guess what. Then test.

in	5	2	3	6	1	4
out	12	3	6	15	0	9

PROBLEM SOLVING

202

LESSON ACTIVITY

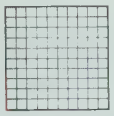
Using the Page

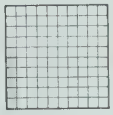
- Many students enjoy make-believe situations. The exercises on this page involve make-believe machines that perform mathematical functions. Similar exercises were encountered first in Unit 3 on page 53, for which the mathematical function was subtraction. In the example on this page, the function of the machine is to add 8 to each number that "goes in". Review what is meant by the "in" and "out" rows of numbers in the table. Have each of six students test the "in" numbers by adding 8 to the numbers, in turn. You may wish to change the function of the machine to "multiply by two" and have students change the numbers of the "out" row accordingly.

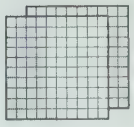
  Review the instructions for Ex. 1-5 with the students. Emphasize the need to test the guess with each "in" number of the table, to be certain that the correct "out" number is obtained each time. For example, in Ex. 1, $15 \div 3 = 5$, and it appears as though the machine divides by 3. However, testing this guess for 12 and 2 proves i not the correct guess. At this point, another guess should made and tested with each "in" number. Ex. 5 invol two machines. The second machine performs an operat on the result obtained from the first machine.

Checking Up

Write a decimal to match each picture.

1. 0.20 

2.  0.06

3.  1.41

Write a decimal for each point marked with an arrow.

4.

5.

Write the words.

6. 0.6 six-tenths
7. 0.38 thirty-eight hundredths
8. 2.03 two and three-hundredths

Write each as a two-place decimal.

9. 0.2 0.20
10. 3.7 3.70

Write each as a one-place decimal.

11. 4.90 4.9
12. 0.10 0.1

Complete.

13. 0.67 shows 6 tenths 7 hundredths, or 67 hundredths.
14. 1 dollar 3 dimes 5 pennies are worth $1.35.
15. 2 dollars 13 dimes are worth $3.30.
16. 3 dimes 17 pennies have the same value as 4 dimes 7 pennies.

Which is greater,

17. 2.7 or 2.3? 2.7
18. 0.36 or 0.63? 0.63

Which is less,

19. 4.2 or 2.2? 2.2
20. 1.65 or 1.68? 1.65

List these numbers in order from least to greatest.

21. 1.88, 1.55, 0.58, 0.81, 1.85, 0.55 0.55, 0.58, 0.81, 1.55, 1.85, 1.88

Add.

22. 2.7 + 3.6 = 6.3
23. 1.58 + 0.74 = 2.32
24. 3.64 + 0.28 + 1.19 = 5.11

Subtract.

25. 9.4 − 3.7 = 5.7
26. 2.30 − 1.68 = 0.62
27. 3.00 − 0.65 = 2.35

Multiply.

28. 0.7 × 3 = 2.1
29. 1.2 × 4 = 4.8
30. 2.6 × 5 = 13.0

Round each to the nearest whole number.

31. 1.2 1
32. 3.8 4
33. 2.5 3

Page 203

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Provide students with cash register tapes from purchases made at grocery stores or drug stores (for five to ten items). Have students write the amounts shown in order from least to greatest.
- Extra practice in addition and subtraction may be provided in the form of number squares as shown. The answer in the lower right square provides a check.

−	+ →
↓	

12.6	9.4	
5.8	2.7	

- Have students write the word names for a group of numbers similar to the following.

640 64.0 6.4 0.64

ills	Exercises	Related Pages
rite decimals to match diagrams	1-3	T 188-T 191
ad a scale marked in decimal tenths or hundredths	4, 5	T 194-T 195
rite names for decimals to 19.99	6-8	T 188-T 191
rite tenths as hundredths	9, 10	T 192-T 193
rite hundredths as tenths	11, 12	T 192-T 193
erpret place value in decimals	13	T 192-T 193
rite amounts of money using two-place decimals	14, 15	T 196-T 197
group amounts of money	16	T 196-T 197
mpare decimals	17-20	T 200-T 201
der decimals	21	T 200-T 201
d decimals, sums to 99.99	22-24	T 202-T 203
btract decimals, minuends to 99.99	25-27	T 204-T 205
ultiply a one-place decimal to 9.9 by a whole number less than 10	28-30	T 208-T 211
ound one-place decimals to 19.9 to the nearest whole number	31-33	T 212-T 213

Comments

If students are uncertain about writing tenths as hundredths and vice versa (Ex. 9-13), provide more experiences with models of tenths and hundredths. Tenth strips may be placed on models of hundredths to help understand decimals such as 67 hundredths as 6 tenths 7 hundredths.

Students experiencing difficulty with Ex. 22-30 may need to review the algorithms with whole numbers to reinforce the concept of regrouping. Some students may also have poor recall of basic multiplication facts and require assistance in mastering them.

Unit 9 Overview

Measurement

This unit explores three types of measurement — linear, area, and volume — using metric units. The unit begins with linear measurement using centimetres, and then develops relationships between centimetres, decimetres, and metres. Decimal notation is used for some of the conversions. Kilometres are introduced for longer measurements and the relationship to metres is developed. Perimeter is presented as the total length of the sides of a polygon; no formulas are developed at this stage for finding the perimeters of rectangles and squares. A lesson on graphing applies some of the concepts and skills associated with linear measurement. The square centimetre and the cubic centimetre are the primary units in the lessons on area and volume. The larger units of square decimetre, square metre, cubic decimetre, and cubic metre are derived from them, but relationships among these units are not presented. Both counting and multiplication are used to find area, but only counting is applied to volume. The unit concludes with a unit check-up and an assessment of skills in the four basic operations with whole numbers and decimals.

Prerequisite Skills

- write decimals to express tenths
- write decimals to express hundredths
- add decimal tenths
- add decimal hundredths
- write a multiplication sentence for an array

Unit Outcomes

- estimate and measure length in centimetres
- express lengths given in one unit of measure in terms of another unit of measure using decimals, for metres, decimetres, and centimetres
- express metres as kilometres and kilometres as metres
- choose the preferred unit of measure (centimetre, decimetre, metre, kilometre) for measuring a given length
- use addition to find the perimeter of a shape whose sides are measured in centimetres, decimetres, or metres; solve related word problems
- draw pictographs and bar graphs to represent sets of data
- find area in square centimetres by counting whole units and half units
- use multiplication to find the area of a rectangular shape in square centimetres, square decimetres, and square metres
- find volume by counting centimetre cubes, decimetre cubes, and metre cubes
- classify an object as smaller than, about the same size as, or larger than a decimetre cube and a metre cube
- construct models to help solve problems

Background

The metric system was introduced in France in the latter part of the eighteenth century by a committee which was formed to develop a rational system of measurement. As a result, the *metre*, *litre*, and *kilogram* were created as standard units. Since then, more and more countries have adopted the system and in 1960, agreements were reached concerning the various units and their symbols. It has been called the *International System of Units*, or SI (from the French name, Le Système Internati d'Unités).

Prior to the adoption of the metric system, most measure systems lacked rational structure. Units of measurement often developed from parts of the body, such as the hand an foot, and varied according to local customs and adaptati Conversions from one unit to another involved such div factors as 2, 3, 4, 5$\frac{1}{2}$, 12, 16, and 5280. The metric syst however, is based on the simple and logical decimal system same as our base-ten numeration system. Units are relate factors such as 10, 100, and 1000, and conversion is ea accomplished from one unit to another by multiplication division. Computation is, therefore, much easier with m measures. Furthermore, the base units for length, capacity, mass are themselves easily related.

The *metre* is the base unit of length. All other units of le are derived by multiplying one metre by a power of ten. Pref added to the word *metre* indicate which power of ten is multiplier. For example, in the word *centimetre* (cm) the pr names the unit as one-hundredth of a metre, and in the w *kilometre* (km) the prefix indicates a unit equal to one thous metres.

Metric measures of area and volume are derived from li units. A square with sides 1 cm long occupies an area of *square centimetre* (1 cm^2), and a cube with edges of 1 occupies a space of *one cubic centimetre* (1 cm^3). As st earlier, easy relationships also exist between units in one kin measure and units in another. *One cubic decimetre* (1 dm^3 one thousand cubic centimetres (1000 cm^3) of water is ca *one litre* (1 L) and has a mass of *one kilogram* (1 kg) or thousand grams (1000 g). Therefore, 1 cm^3 of water has a m of 1 g.

Mass refers to the quantity of matter in an object and may measured by balancing an object and standard units of mass balance scale. Mass is not the same as weight. Weight is measure of force required to lift an object and it can v because it is affected by the force of gravity. Mass cannot va

As soon as students learn more than one unit of measur each kind of measurement they are faced with the need to se the one most appropriate to the situation. For example, centimetre is satisfactory for measuring many small obje such as pieces of paper or ribbon, and small boxes; but measuring the width of a house, the length of a fence, or depth of a lake, the metre is more suitable. The next difficu that students encounter is one of precision in measurement. example, an object said to be 2 cm in length may have a len greater than 2 cm but less than 3 cm. It is frequently necess to name the length of any object to the nearest unit, by stat that its length is *about* a certain number of units. Estimat involves similar approximation using the word *about*, but i even less precise since the number of units is not determined any standard measuring device. Only direct experience measuring objects with standard units can provide any degree expertise in estimating with measures.

There is no direct relationship between perimeter and ar This can be discovered by students using a geoboard or gra paper. For example, in forming different rectangular shapes t have a perimeter of 16 cm, for instance, students can disco that for rectangular shapes the square has the greatest area (The opposite is also true, that for a given area, the square has least perimeter (B).

A

Length	Width	Perimeter	Area
7 cm	1 cm	16 cm	7 cm^2
6 cm	2 cm	16 cm	12 cm^2
5 cm	3 cm	16 cm	15 cm^2
4 cm	4 cm	16 cm	16 cm^2

B

Length	Width	Perimeter	Area
64 cm	1 cm	130 cm	64 cm^2
32 cm	2 cm	68 cm	64 cm^2
16 cm	4 cm	40 cm	64 cm^2
8 cm	8 cm	32 cm	64 cm^2

ching Strategies

tudents have probably had a number of measuring experi-es in previous grades, using both non-standard and standard s. They need many opportunities to continue such experi-es with emphasis on the use of appropriate standard units. this purpose, a measurement area or table may be set up in part of the classroom. It should have a variety of items to be asured, as well as centimetre rulers and metre sticks, timetre squares and decimetre squares, and centimetre cubes decimetre cubes. (See *Materials* for specific items.) ur-sided'' metre sticks available commercially are useful e each of four faces depicts a metre differently, as timetres, decimetres, quarter metres, and half metres. Cards gesting a variety of measuring activities can provide dance for students to supplement the lessons with valuable ct experience. As stated earlier, it is only through such vities that they can acquire skills in estimating and suring. An estimate should be a carefully considered nion. Students who make reasonable estimates with a unit e developed a feeling for the magnitude represented by that . In developing estimating skills, it is important that mates be recorded before actual measurements are made.

n developing relationships between linear units with the lents, charts may be displayed for handy reference and for dental learning.

10 cm = 1 dm
10 dm = 1 m
100 cm = 1 m
1000 m = 1 km

1 cm = 0.1 dm
1 dm = 0.1 m
1 cm = 0.01 m

Conversions between units can be achieved initially by aming them in parts and then replacing them with their ivalents. With preliminary steps such as those illustrated w, students can make simple conversions and note, by nparing the equivalent measures, the position of the decimal nt as the unit is changed. The exercises on page 209 are gned to emphasize the easy conversion by using decimals.

165 cm = 100 cm and 65 cm
165 cm = 1 m and 0.65 m
165 cm = 1.65 m

3.5 m = 3 m and 0.5 m
3.5 m = 300 cm and 50 cm
3.5 m = 350 cm

Familiarity with the kilometre can be acquired by naming distances between known places in the community in terms of kilometres. Also, students can find how long it takes to walk, run, ride a bicycle, or ride in a car a distance of one kilometre. Again, direct experience is the best teacher.

In connection with the lessons dealing with perimeter, area, and volume, new materials are needed in the mathematics center. These are listed under *Materials*. Whether, or not, an overhead projector is used to present the lesson on pages 216 and 217, centimetre grid transparencies should be available in the mathematics center, so that students can place them over shapes to find area by counting centimetre squares. Provide cutouts of shapes similar to those on page 216. Small boxes and cartons are also needed for students to fill with centimetre cubes. Certain metre sticks can interlock to show a square metre and a cubic metre (see pages 220 and 223). For some base-ten blocks, the model for hundreds is 1 dm^2 (100 cm^2) and the model for thousands is 1 dm^3 (1000 cm^3).

The results of the unit check-up should be analyzed to determine which students need more experience, and which kinds of experience, with metric units. They may then be directed to the various activities suggested in the text, the lesson outlines, and *Related Activities*.

Note the students' errors in the exercises of *Checking Skills* (page 227) and plan appropriate reteaching, review, and practice for groups and individual students. The lesson outline for this page describes the arrangement of the exercises according to specific skills.

Materials

centimetre ruler for each student
decimetre strips (optional)
objects whose lengths are to be measured (string, ribbon, belt, skipping rope, necktie, shoelace, paper clips, and so on)
metre sticks and tape measures marked in decimetres and centimetres
tracing paper, graph paper (copies of pages T 367 and T 368)
objects for Ex. 7 on page 212 and Ex. 9-14 on page 213 (sheets of paper, paper towel, crayon box, dollar bill, ruler)
overhead projector, centimetre grid transparency, transparency showing two unmarked rectangles (4 cm by 7 cm and 5 cm by 6 cm), cutouts of these rectangles
centimetre squares, decimetre squares (copies of page T 363)
centimetre cubes, larger cubes, decimetre cubes

Vocabulary

centimetre, cm
decimetre, dm
metre, m
kilometre, km
perimeter
area
volume
to the nearest centimetre
square centimetre, cm^2
square decimetre, dm^2
square metre, m^2
cubic centimetre, cm^3
cubic decimetre, dm^3
cubic metre, m^3

LESSON OUTCOME

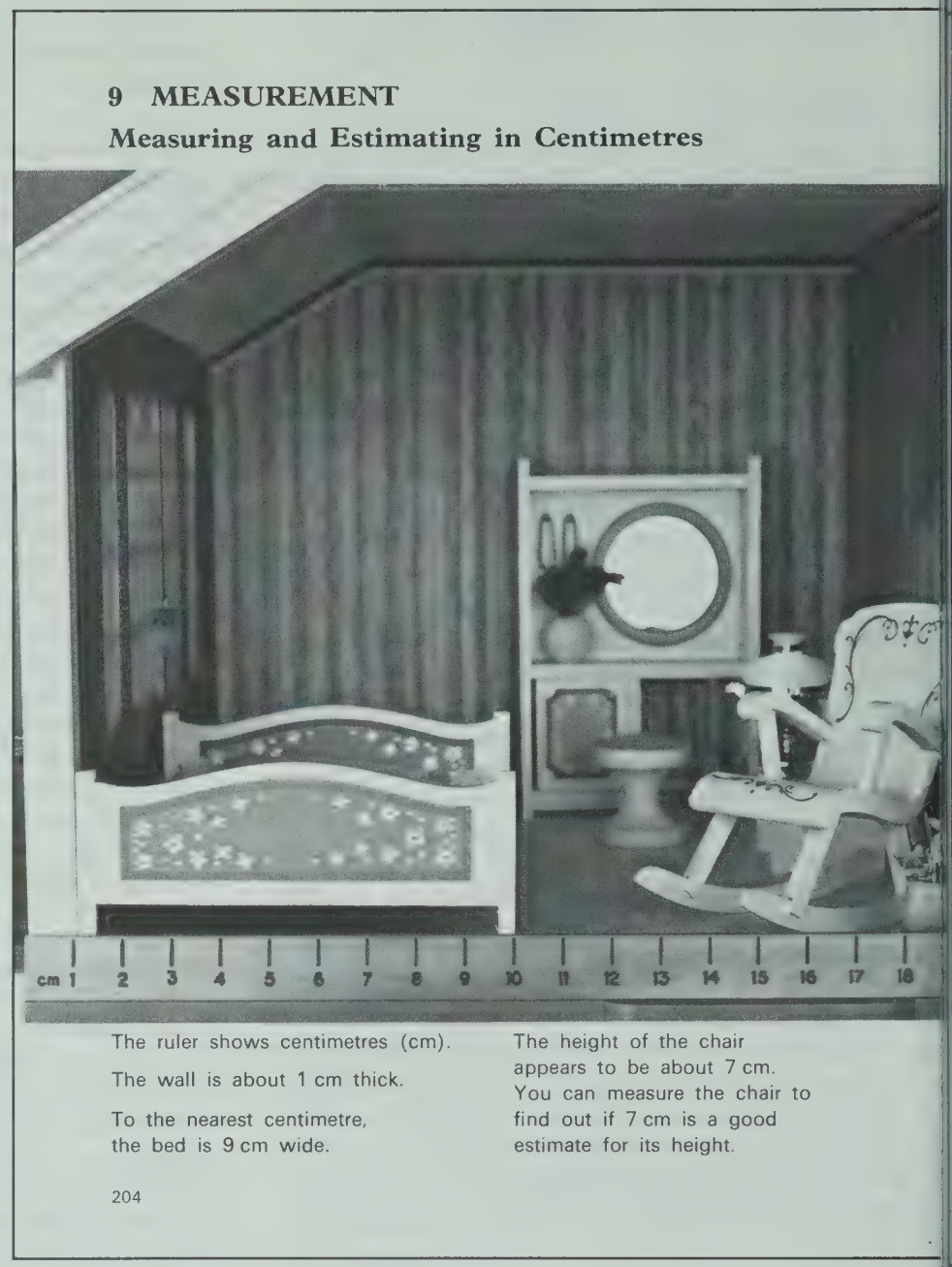
Estimate and measure length in centimetres

Materials

centimetre ruler for each student

Vocabulary

centimetre, cm, to the nearest centimetre


9 MEASUREMENT
Measuring and Estimating in Centimetres
cm 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
The ruler shows centimetres (cm).
The wall is about 1 cm thick.
To the nearest centimetre, the bed is 9 cm wide.
The height of the chair appears to be about 7 cm. You can measure the chair to find out if 7 cm is a good estimate for its height.
204

LESSON ACTIVITY

Using the Pages

- Have a student read the titles at the top of page 204 to introduce the topic. Have the students identify the units marked on the yellow ruler as *centimetres*. Ask what symbol stands for centimetres (it appears on the left end of the ruler). Discuss that since the centimetre is a small unit of measure, it is suitable for measuring the lengths of small objects such as those found in a doll's house. Have students name objects they recognize in the two photographs. Ask them to estimate the width of page 204.

  Discuss the statements beneath the photograph on page 204. Have a student explain why the width of the bed is 9 cm and not 10 cm as one might think from a quick glance at the ruler. Some students may not understand the meaning of the phrase "to the nearest centimetre". Have them align their own centimetre rulers with the width of the bed to observe that the width is between 8 cm and 9 cm, but is closer to 9 cm. Then have them measure to check the estimate of 7 cm for the height of the chair. Have th estimate and measure other lengths in the same photograp for example, the height of the bed, the height of the sto and the width of the dressing table. Ensure that each stud aligns her/his ruler correctly with the object to be measu because some rulers show a mark for 0, whereas others not.

Working Together: The exercises relate to the photograph page 204. The chart is an organized way of recordi estimates and measurements. You may wish to have t students extend the chart to include other objects in t photograph. Ensure that estimates are written in the ch before measurements are taken.

Exercises: Have the students prepare their charts first, writi the names of the selected objects. Emphasize th measurements are taken after estimates have been writte You may prepare a chart on the board or on a large sheet paper. Students may contribute examples from their ov charts in compiling the class chart.

Working Together

Complete the chart. Estimate first. Then use a centimetre ruler and measure the height of each to the nearest centimetre.

	Item	Estimate	Measurement
1.	rocking chair	7 cm	about 7 cm
2.	bedroom ceiling	____ cm	about 11 cm

Answers will vary

Exercises

Make a chart. Choose 5 items from the picture. Make an estimate. Then measure each to the nearest centimetre.

	Item	Estimate	Measurement
1.	height of chair	Answers will vary ____ cm	about 6 cm
2.	diameter of table	____ cm	about 7 cm

Answers will vary

205

RELATED ACTIVITIES

- Provide opportunities for students to estimate and measure various lengths in the school environment. Have them show their results in a chart like the ones on page 205. Remind the students to write their estimates first.

Item	Estimate	Measurement
chalkbrush		
chalk		
crayon		
eraser		

- Have the students measure lengths that are curved rather than straight. Provide them with string or ribbon to help make the measurements. The measurements may be shown in a chart. Strings cut to match the lengths may be taped to a large sheet of centimetre graph paper to form a type of bar graph.

Distance around	Estimate	Measurement
my wrist		
my waist		
clock face		
wastebasket		

- Have students identify as many objects in their environment as possible whose lengths are 1 cm to the nearest centimetre. These will be helpful as referrents in estimating different lengths. Some examples are the width of a paper clip, the diameter of a thumb tack, the thickness of an eraser, and the width of one's smallest finger.

sessment

a centimetre ruler.

mate and then measure each length to the nearest centimetre.

Item	Estimate	Measurement
the length of your mathematics book	_____ cm	about _____ cm
the length of a paper clip	_____ cm	about _____ cm
the width of your desk	_____ cm	about _____ cm

Answers will vary.

Page 206

LESSON OUTCOME

Express decimetres as centimetres and centimetres as decimetres using decimals

Materials

decimetre strips (optional); centimetre rulers; string, ribbon, and other suitable objects whose lengths can be measured

Vocabulary

decimetre, dm

Prerequisite Skills

Write decimals to express tenths

Checking Prerequisite Skills

Write each as a decimal.

1. 14 tenths 1.4 **2.** 4 tenths 0.4

Complete.

3. 1.6 = 16 tenths

4. 0.3 = 3 tenths

RELATED ACTIVITIES

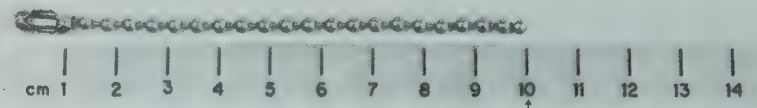
- By completing tables similar to the following, students may see a pattern regarding the position of the decimal point.

cm	3	13	23	33	43	53
dm	0.3	1.3				

dm	0.1	0.5	1.0	1.5	2.0	2.5
cm	1	5				

Decimetres, Centimetres, and Decimals

A decimetre (dm) equals 10 cm. The chain is 1 dm long.



10 cm
1.0 dm

10 cm = 1 dm

A centimetre is 1 of 10 equal parts of a decimetre.
A centimetre is one-tenth of a decimetre.

1 cm = 0.1 dm

The connector on the chain is 1 cm or 0.1 dm long.

Working Together

Give each length in decimetres.

Example: 13 cm = 10 cm and 3 cm
13 cm = 1 dm and 0.3 dm
13 cm = 1.3 dm

Give each length in centimetres.

Example: 1.2 dm = 1 dm and 0.2 dm
1.2 dm = 10 cm and 2 cm
1.2 dm = 12 cm

1. 15 cm 1.5 dm **2.** 20 cm 2 dm **3.** 5 cm 0.5 dm **4.** 1.4 dm 14 cm **5.** 3 dm 30 cm **6.** 0.8 dm 8 cm

Estimate the lengths in centimetres. Then give your estimates in decimetres. Measure to check your estimates. Estimates will vary for Ex 7-9.

7. 11 cm **8.** 2 cm **9.** 14 cm

Exercises

Copy and complete this chart. Answers will vary for Ex. 1-10.

	Item	Estimate	Measurement
1.	your pencil	cm or dm	cm or dm
2.	the length of this book	cm or dm	cm or dm
3.	the width of your hand	cm or dm	cm or dm
4.	the length of a hair ribbon	cm or dm	cm or dm
5–10.	List 6 items of your own.	cm or dm	cm or dm

206

LESSON ACTIVITY

Before Using the Page

- If students have not encountered decimetres in their earlier work in mathematics, provide opportunities for them to estimate, measure, and record lengths in decimetres. Provide each student with a strip of paper 1 dm in length and longer strips marked in decimetre units.

Using the Page

- The photograph illustrates the relationship between centimetres and decimetres. Develop that since 1 cm is 1 of 10 equal parts of a decimetre, decimals are useful in expressing one unit in terms of the other. Have students give the length of the chain and the connector on the chain in two ways. Emphasize that 10 cm and 1 dm name the same length, and 1 cm and 0.1 dm name the same length. Point out the symbol dm for decimetres. Have students name from 2 cm to 9 cm as tenths of a decimetre and write the decimals.

Working Together: Two examples are provided to h students understand the thought process for expressing e unit in terms of the other. Students may refer to centimetre ruler pictured at the top of the page to h understand the examples. Have them follow a sim thought pattern to complete Ex. 1-6. For Ex. 7-9, h them write their estimates before measuring to check. N that estimates and measurements are to be made centimetres, and these are then expressed as decimetre

Exercises: Provide students with string, ribbon, or other suita objects for Ex. 4. Point out that they will be choosing th own items for Ex. 5-10.

Assessment

Give each length in decimetres.

1. 17 cm 1.7dm **2.** 10 cm 1.0dm **3.** 3 cm 0.3dm

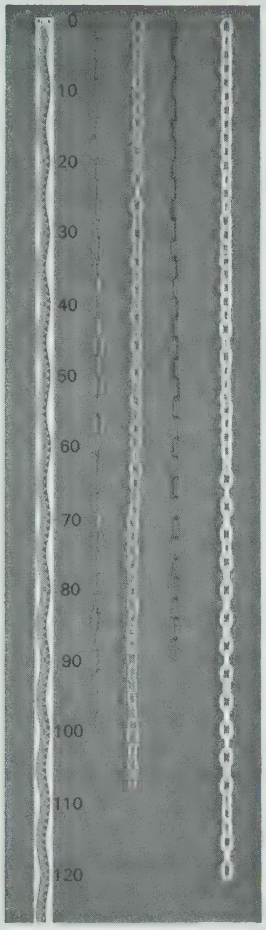
Give each length in centimetres.

4. 1.2 dm 12cm **5.** 2 dm 20cm **6.** 0.6 dm 6cm

Metres, Centimetres, and Decimals

The purple chain is 100 cm or 1 m (metre) long.

100 cm = 1 m



A centimetre is 1 of 100 equal parts of a metre.
A centimetre is one-hundredth of a metre.

1 cm = 0.01 m

The white chain is 121 cm long.
The white chain is 1 m and 21 cm or 1.21 m long.
The blue chain is 90 cm or 0.90 m long.

Working Together

Give each length in metres.

1. 125 cm 1.25 m
2. 108 cm 1.08 m
3. 75 cm 0.75 m

Give each length in centimetres.

4. 1.18 m 118 cm
5. 0.90 m 90 cm
6. 1.03 m 103 cm

How long is the yellow chain

7. in centimetres? 110 cm
8. in metres? 1.10 m

Measure each in centimetres.
Then give each length in metres.

9. from the floor to your nose
10. a side of your desk

Answers will vary for Ex 9-10

Exercises

Measure each in centimetres.
Then give each length in metres. Answers will vary for Ex 1-12

1. your foot
2. a bookcase
3. how wide you can smile
4. from the floor to your knee
5. from the floor to your waist
6. from the floor to your chin
7. a belt you wear
8. a skipping rope
9. a necktie
10. a shoelace

*11. a chain of 50 paper clips

*12. the string used to tie a box

LESSON OUTCOME

Express metres as centimetres and centimetres as metres using decimals

Materials

metre sticks and tape measures marked in centimetres, various objects to be measured (belt, skipping rope, necktie, shoelace, paper clips, string)

Vocabulary

metre, m

Prerequisite Skills

Write decimals to express hundredths

Checking Prerequisite Skills

Write the decimals.

1. 1 and 21 hundredths 1.21
2. 1 and 7 hundredths 1.07
3. 60 hundredths 0.60
4. 75 hundredths 0.75
5. 1 and 40 hundredths 1.40

RELATED ACTIVITIES

- Have students complete tables similar to the following.

m	?	?	2.75	1	1.25	?
cm	25	50	?	?	?	250

- Have students name objects whose lengths are about one metre.

LESSON ACTIVITY

Before Using the Page

Some students may need opportunities to estimate and measure lengths in metres to help them recall the metre as a unit of length.

Using the Page

Begin with a discussion of the photograph. Develop that the tape measure is marked in centimetres. Have students read the length of each of the four chains. Ask if there is another way to name a length of 100 cm. (Some students may suggest 10 dm.) Have a student read the statement above the photograph that develops the relation 100 cm = 1 m. Ask which chains are longer than 1 m and which are shorter. Ask for another way to name 1 cm. (Some students may suggest 0.1 dm.) Read the statements that develop the relation 1 cm = 0.01 m. Summarize that at times it is necessary, or more convenient, to express lengths in centimetres as metres, or vice versa, and that decimals help to do this. Have students help to explain the statements about the white chain and the blue chain, using examples on the board, if necessary.

For example, 121 cm = 100 cm and 21 cm
= 1 m and 0.21 m
= 1.21 m

Working Together: Note that for Ex. 9 and 10, the lengths are measured in centimetres which are then expressed as metres.

Exercises: You may wish to have the students work in pairs to help one another with the measurements. Answers to Ex. 11 and 12 will vary.

Assessment

Give each length in metres.

1. 145 cm 1.45m
2. 107 cm 1.07m
3. 25 cm 0.25m

Give each length in centimetres.

4. 1.21 m 121cm
5. 0.80 m 80cm
6. 1.02 m 102cm

Pages 208-209

LESSON OUTCOME

Express lengths given in one unit of measure in terms of another unit of measure using decimals, for metres, decimetres, and centimetres

Materials

metre sticks and tape measures marked in decimetres and centimetres

Prerequisite Skills

Write decimals to express tenths and hundredths

Checking Prerequisite Skills

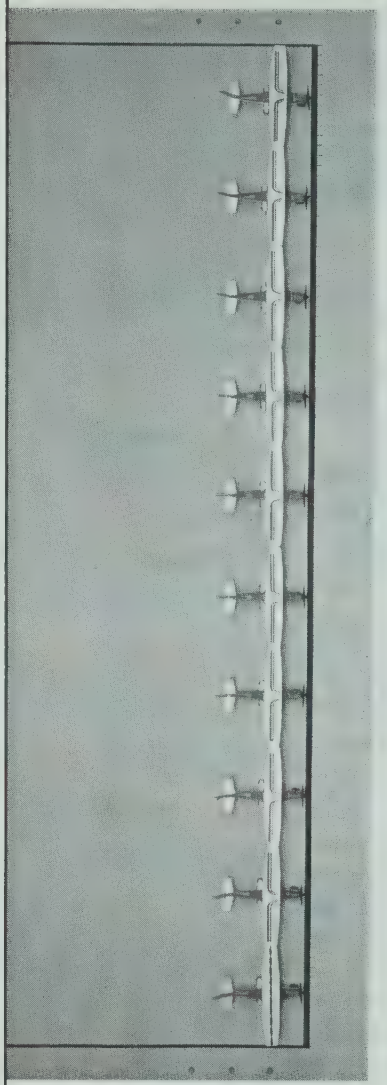
Write the decimals.

1. 12 tenths 1.2
2. 7 tenths 0.7
3. 1 and 25 hundredths 1.25
4. 9 hundredths 0.09
5. 90 hundredths 0.90

Complete.

6. 1.7 = 17 tenths
7. 0.2 = 2 tenths

Metres, Decimetres, Centimetres, and Decimals



The length of the runway is 1 m.
Each wingspan is 1 dm.
The length of each propeller blade is 1 cm.

10 cm = 1 dm 1 cm = 0.1 dm
10 dm = 1 m 1 dm = 0.1 m
100 cm = 1 m 1 cm = 0.01 m

The lights at the top of the runway are 104 cm from the lights at the bottom.

104 cm = 100 cm and 4 cm
104 cm = 10 dm and 0.4 dm
104 cm = 10.4 dm

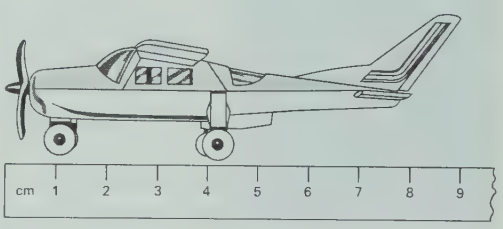
104 cm = 100 cm and 4 cm
104 cm = 1 m and 0.04 m
104 cm = 1.04 m

The lights at the top are 10.4 dm or 1.04 m from the lights at the bottom.

Each airplane is 9 cm from nose to tail.

9 cm = 0.9 dm 9 cm = 0.09 m

Each airplane is 0.9 dm or 0.09 m long.



208

LESSON ACTIVITY

Before Using the Pages

- Have students name the three units of length they have encountered in the preceding lessons. Ask which units are appropriate for measuring longer lengths and which are appropriate for measuring shorter lengths. Review the following relations.

10 cm = 1 dm
1 cm = 0.1 dm
100 cm = 1 m
1 cm = 0.01 m

Ask how many decimetres are the same length as 1 m. Use a metre stick marked in decimetres to develop the relations 10 dm = 1 m and 1 dm = 0.1 m. Discuss that since the three units of length are related in terms of ones, tens, and hundreds, (or ones, tenths, and hundredths) decimals are frequently used in expressing one unit of length in terms of another unit.

Using the Pages

- Discuss the photograph of the toy airplanes. For examp read the statement that the length of the runway is 1 m a have students name the same length two other wa (10 dm, 100 cm). Have them count the airplanes t match the length of the runway and name the wingspan each airplane three ways (0.1 m, 1 dm, 10 cm). Read t statement that the length of each propeller blade is 1 c and have students name the same length two other wa (0.1 dm, 0.01 m). Summarize these relationships having students read the six pairs of equivalent me urements at the top of page 208.

Have students identify the runway lights in the pho graph. Lead the students through the statements th develop the relations

104 cm = 10.4 dm and 104 cm = 1.04 m.

Emphasize that the three statements all name the sa length. Use a similar procedure to develop the relations

9 cm = 0.9 dm and 9 cm = 0.09 m.

Working Together

Copy and complete the chart.

1.	156 cm	15.6 dm	1.56 m
2.	123 cm	12.3 dm	1.23 m
3.	47 cm	4.7 dm	0.47 m
4.	30 cm	3 dm	0.3 m
5.	7 cm	0.7 dm	0.07 m
6.	23 cm	2.3 dm	0.23 m
7.	160 cm	16 dm	1.6 m

Measure. Give each measurement in centimetres, in decimetres, and in metres.

8. your height **9.** a giant step

Answers will vary for Ex. 8-9.

Exercises

Copy and complete the chart.

1.	372 cm	37.2 dm	3.72 m
2.	135 cm	13.5 dm	1.35 m
3.	106 cm	10.6 dm	1.06 m
4.	209 cm	20.9 dm	2.09 m
5.	70 cm	7 dm	0.7 m
6.	86 cm	8.6 dm	0.86 m
7.	500 cm	50 dm	5 m
8.	8 cm	0.8 dm	0.08 m
9.	40 cm	4 dm	0.4 m

Measure. Give each measurement in centimetres, in decimetres, and in metres.

10. your arm span **11.** a standing long jump

12. from your nose to the fingertips of your outstretched hand

13–17. how high you can reach lying down, sitting on the floor, kneeling, standing, jumping

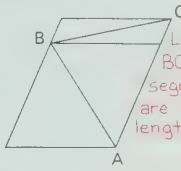
***18.** how far you jump off the ground when you jump straight up

Answers will vary for Ex. 10-18.

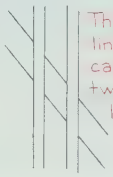
For each picture, give a true statement that *looks* as if it is not true.

1.

The two vertical lines in the rectangle are parallel.

2. 

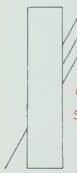
Line segment BC and line segment BA are equal in length.

3. 

The slanting line segments can make two parallel line segments.

4.

The two parallel line segments are equal in length.

5. 

The line segment on the left is the extension of the middle line segment on the right.

try this

209

RELATED ACTIVITIES

- The measurement taken for Ex. 1-12 on page 207 may be expressed as decimetres.
- Students may benefit by completing patterns in tables similar to the following.

metres	1	2		9
decimetres	10	20		90
centimetres	100	200		900

metres	0.1	0.2		0.9
decimetres	1	2		9
centimetres	10	20		90

metres	0.01	0.02		0.09
decimetres	0.1	0.2		0.9
centimetres	1	2		9

rking Together: Some students may find it easier to complete the chart if they refer to a metre stick marked in centimetres. You may wish to have the students work in pairs for Ex. 8 and 9 to help one another with measuring.

ercises: Provide the students with metre sticks and tape measures for Ex. 10-18. For Ex. 13-17, the students may find it convenient to work beside a wall, showing how high they can reach on the wall. They may place a chalk mark on the wall for each reach. The results may be written in a chart similar to one shown for Ex. 1-9. Ex. 18 can motivate a discussion about how the distance may be measured.

y This: You may wish to discuss these exercises orally rather than have the students give written answers. Diagrams such as these are often referred to as optical illusions. For example, in Ex. 1, two vertical lines give the illusion of being curved when, in fact, they are not only straight but parallel as well. This may be verified by using a straight edge. In Ex. 2, line segment BA does not appear to be the same length as line segment BC.

Assessment

Copy and complete the chart.

1.	145 cm	14.5 dm	1.45 m
2.	122 cm	12.2 dm	1.22 m
3.	104 cm	10.4 dm	1.04 m
4.	50 cm	5.0 dm	0.5 m
5.	12 cm	1.2 dm	0.12 m

Page 210

LESSON OUTCOME

Express metres as kilometres and kilometres as metres

Vocabulary

kilometre, km

RELATED ACTIVITIES

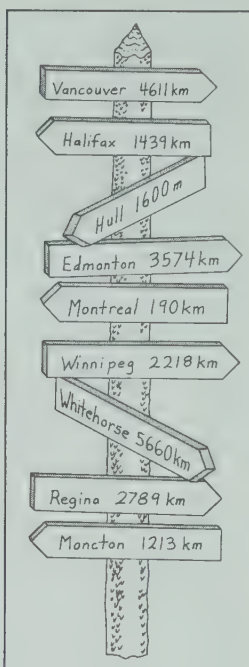
- Have students use metre sticks or tape measures to mark a distance of 100 m on the schoolyard.

During gym classes you may wish to have students walk 100 m and time them to the nearest second. Have them determine how long it would take them to walk 1 km at that rate of walking.

- Small groups of students accompanied by an adult may use one-metre trundle wheels to measure distances of 1 km from the front door of the school. Each group would proceed in a different direction and identify an object at the point where a distance of 1 km is reached.

One student may act as a recorder to note each hundred as the others count from 1 to 100 each time, until there are 10 hundreds (1000).

Kilometres and Metres



Study the signpost.

1. Which direction must you be facing to read these signs? South
2. In which city could there be a signpost like this one? Ottawa

PROBLEM SOLVING

Run the length of a soccer field 10 times and you run about 1000 m.

1000 m = 1 km (1 kilometre)

Run the length of a soccer field 10 times and you run about 1 km.

Working Together

Give each distance in kilometres.

1. 2000 m — 2 km
2. 25 000 m — 25 km

Give each distance in metres.

3. 5 km — 5000 m
4. 16 km — 16 000 m

Make a list.

5. Name things that are about 1 km from your school. Answers will vary.

Exercises

Give each distance in kilometres.

1. 3000 m — 3 km
2. 16 000 m — 16 km
3. 1000 m — 1 km
4. 500 000 m — 500 km
5. 42 000 m — 42 km
6. 20 000 m — 20 km

Give each distance in metres.

7. 1 km — 1000 m
8. 52 km — 52 000 m
9. 100 km — 100 000 m
10. 18 km — 18 000 m
11. 120 km — 120 000 m
12. 7 km — 7 000 m

Is the distance greater than or less than 1 km from your school to the nearest

13. house?
14. grocery store?
15. gas station?
16. railway track?
17. fire station?
18. traffic light?
19. police station?
20. fire hydrant?
21. bus stop?
22. pay telephone?
23. post office?
24. farm?

Answers will vary for Ex 13-24.

210

LESSON ACTIVITY

Using the Page

- Have students identify the unit of length introduced on this page and suggest where they have seen this unit, the kilometre, in use. They may suggest road maps, highway signs, and automobile odometers. Point out that lengths such as the distance between cities are too great for measuring conveniently in metres. Read the statements to introduce the relation 1000 m = 1 km. (Have the students observe the photograph of the soccer field on page 211.) Have students name 2000 m, 3000 m, 4000 m, and 5000 m as kilometres. Have them name 6 km, 7 km, 8 km, and 9 km as metres. You may wish to have them read the numerals for the distances shown on the signposts in the *Problem Solving* feature.

Working Together: You may wish to prepare a class list with the students for Ex. 5.

Exercises: To help students answer Ex. 13-24, they may thi in terms of 10 soccer fields placed end to end. The exercises can stimulate a discussion of facilities found the neighborhood of the school and help students to think long distances in terms of kilometres.

Problem Solving: These exercises deal with the skill of solvi a problem which does not follow a previously learn pattern, such as using one or more operations. background of knowledge from other areas of study sometimes needed to solve problems. In this case, awareness of the locations of several cities, which the sig indicate are opposite, provides clues for determining t directions.

Assessment

Give each distance in kilometres.

1. 16 000 m — 16 km
2. 340 000 m — 340 km

Give each distance in metres.

3. 5 km — 5000 m
4. 18 k — 18 000 r

Page 211

Choosing a Unit of Length

The two goal nets are less than 1 km apart.

The kilometre is too great to use for measuring the distance between the goal nets.

There are many centimetres from one net to the other.

The centimetre is too small.

Goal nets on a soccer field are about 100 m apart.

The metre is best for measuring this distance.

Exercises

Make a chart as suggested. Use a check to show the unit you would use to measure each of these.

	cm	dm	m	km
1.			✓	
2.				
3.				

1. from one soccer goal net to the other m
2. a ballpoint pen cm
3. an airplane trip km
4. a canoe dm
5. a worm cm
6. an elephant m
7. a mouse cm
8. a hiking trail km
9. a dollar bill cm
10. the school gym m
11. the Mackenzie River km
12. an eraser cm
13. a flag pole m
14. the distance across Canada km
15. a nail cm

211

LESSON OUTCOME

Choose the preferred unit of measure (centimetre, decimetre, metre, kilometre) for measuring a given length

RELATED ACTIVITIES

- Have students use cm, dm, m, or km to best complete sentences similar to the following.

1. The height of the wall is 2 _____.
2. The width of the piano is 14 _____.
3. The length of my nose is 4 _____.
4. The bus route covers a distance of 25 _____.

SSON ACTIVITY

ng the Page

ave the students study the photograph. Read and discuss the statements beneath the photograph. Summarize that for the four units of length (kilometre, metre, decimetre, centimetre), some are suitable for measuring short lengths and others are preferable for longer lengths. Ask which unit is probably best for measuring lengths such as the width of the soccer field, the height of the goal posts, the height of the goalie, and the distance around the soccer ball.

rcises: An oral discussion of the students' written answers would be beneficial to enable them to share their ideas and opinions. This would ensure that they have reasons for their choices and are not making haphazard guesses. The students may observe that the decimetre is used the least.

Assessment

Tell whether you would use the kilometre, metre, decimetre, or centimetre to measure

1. the distance from your class to the principal's office metre
2. the length of a tiger's whiskers centimetre
3. the distance from Ottawa to Edmonton kilometre
4. the length of a tiger's tail decimetre

Pages 212-213

LESSON OUTCOME

Use addition to find the perimeter of a shape whose sides are measured in centimetres, decimetres, or metres; solve related word problems

Materials

centimetre ruler for each student, objects described in Ex. 7 on page 212 and in Ex. 9-14 on page 213

Vocabulary

perimeter

Prerequisite Skills

Add decimal tenths; add decimal hundredths; measure line segments in centimetres

Checking Prerequisite Skills

Add.

1. 2.2 + 3.4 + 1.7 + 2.6 = 9.9

2. 1.23 + 3.14 + 1.68 + 1.45 = 7.50

Use an unmarked straight edge.

3. Draw two line segments. Using a centimetre ruler, measure to the nearest centimetre each of the line segments you drew.

Answers will vary.

Finding the Perimeter

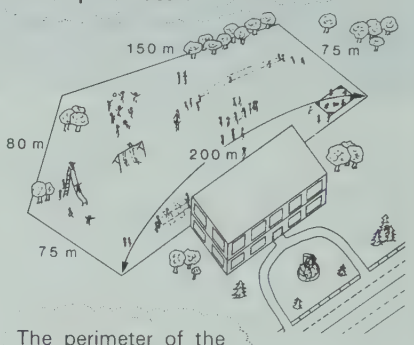
Jack walked around the schoolyard at its edge. How far did he walk?

Add the lengths of the five sides.

$$\begin{array}{r} {\scriptstyle 2\ 1} \\ 200 \\ 75 \\ 80 \\ 150 \\ 75 \\ \hline 580 \end{array}$$

Jack walked 580 m.

The distance around a shape is its **perimeter**.

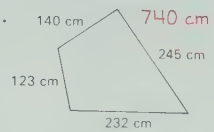


The perimeter of the schoolyard is 580 m.

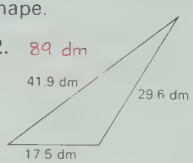
Working Together

Find the perimeter of each shape.

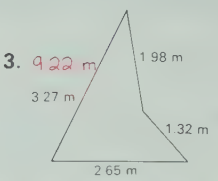
1. 740 cm



2. 89 dm

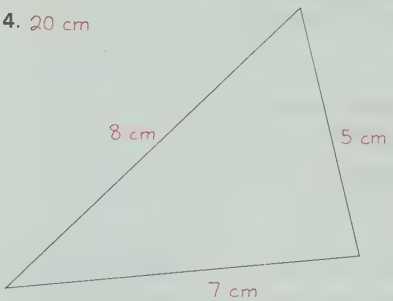


3. 9.22 m

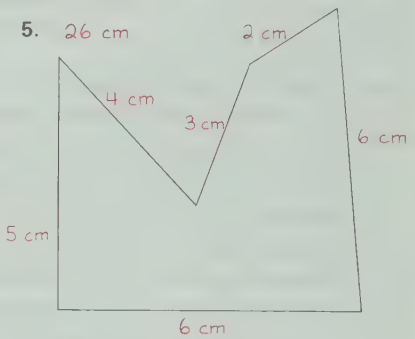


Use a centimetre ruler and find the perimeter of each.

4. 20 cm



5. 26 cm



6. the front cover of this book

93 cm

7. the bottom of a crayon box

Answers will vary.

212

LESSON ACTIVITY

Using the Pages

- Have students study the diagram of the schoolyard and name the length of each side of the yard. (You may wish to discuss that the shape is a pentagon.) Introduce the problem and have students check the addition. Establish that the distance around a shape is the *perimeter* of the shape. (Note how the spelling differs from the word *metre*.) For the perimeter of the schoolyard in the diagram, Jack started at one point and walked along the sides until he reached his starting point again. Emphasize that he might have started at a different point as long as he stopped when he reached that point again. Draw attention to the concluding statement which shows the unit of measure.

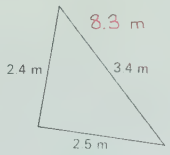
Working Together: Ex. 1-3 represent shapes with the indicated dimensions. The skill being dealt with is the addition of the measures. For Ex. 4 and 5, students must measure the si of the shapes. Note whether errors are due to measur incorrectly or to adding incorrectly, and provide ot similar exercises as needed. Ex. 6 and 7 involve measur the edges of real objects to determine their perime Substitute a different object for the crayon box in Ex. 7 i is not readily available. (For the crayon box, you may n to arrive at an agreement about which surface is bottom.)

Exercises: You may wish to have students use play money cutouts from page T352 for Ex. 13. You may wish to h students recall facts about the sides of a square and o rectangle in preparation for Ex. 15-17. It is recommen that you have students draw diagrams using a straight e for Ex. 15-18, and label the diagrams with the indica dimensions, before they write the additions. Determ whether any students thought of using multiplication answer Ex. 16 and, possibly, Ex. 17.

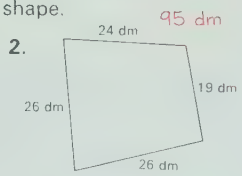
Exercises

Find the perimeter of each shape.

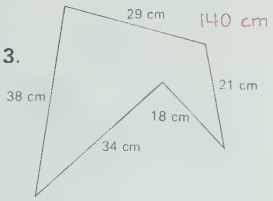
1. 8.3 m



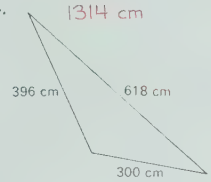
2. 95 dm



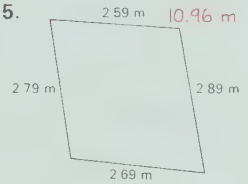
3. 140 cm



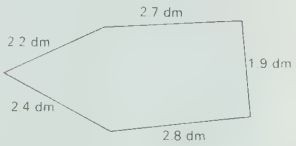
4. 1314 cm



5. 10.96 m

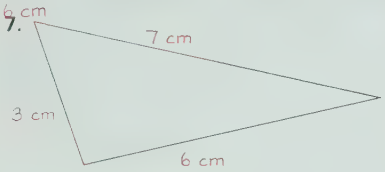


6. 12 dm

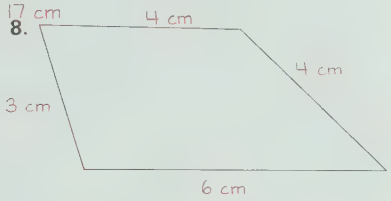


Use a centimetre ruler to find the perimeter of each.

7. 16 cm



8. 17 cm



9. a sheet of paper Answers will vary.
10. a paper towel Answers will vary
11. a sheet of paper folded in half Answers will vary
12. the front of a crayon box Answers will vary
13. a dollar bill about 44 cm
14. the ruler you are using Answers will vary

Solve.

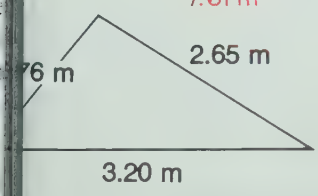
15. Jack's school building is 80 m long and 40 m wide. Find its perimeter. 240 m
16. Find the perimeter of a square that has one side 5 cm long. 20 cm
17. Angela wants to make a pen for her rabbits. It will have the shape of a rectangle. One side will be 5 m long. Another side will be 3.5 m long. What will be its perimeter? 17 m
18. Leah's family has a piece of land that has seven sides. The sides measure 700 m, 80 m, 70 m, 1500 m, 500 m, 400 m, and 480 m. Find the perimeter of this piece of land. 3730 m

213

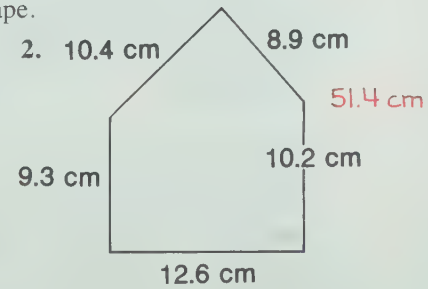
sessment

d the perimeter of each shape.

7.61 m



2.



a square that has one side 12 cm 48 cm

4. a rectangular building 75 m long and 35 m wide 220 m

RELATED ACTIVITIES

- Have students find the perimeter of various objects by first measuring the edges using the appropriate unit of length.
- Find the perimeter of each of these.
  - the schoolyard
  - the gymnasium
  - the classroom
  - a desk top
  - the chalkboard
  - the display board
- Have students use lengths of string to help find the perimeter of objects that have curved edges, such as a ball, a wastebasket, a wrist, and a knee.
- Have students use a straight edge to draw polygons having not more than eight sides. Have other students measure the sides to the nearest centimetre and find the perimeter of each polygon.
- For Ex. 1-6 on page 213, students may write the perimeter in terms of a different unit of length. For example, for Ex. 1, the perimeter is 8.3 m, or 83 dm, or 830 cm.

Pages 214-215

LESSON OUTCOME

Draw pictographs and bar graphs to represent sets of data

Materials

tracing paper, centimetre rulers, graph paper (use copies of page T 367 or page T 368)

Prerequisite Skills

Express length given in one unit of measure in terms of another unit of measure using decimals, for metres, decimetres, and centimetres

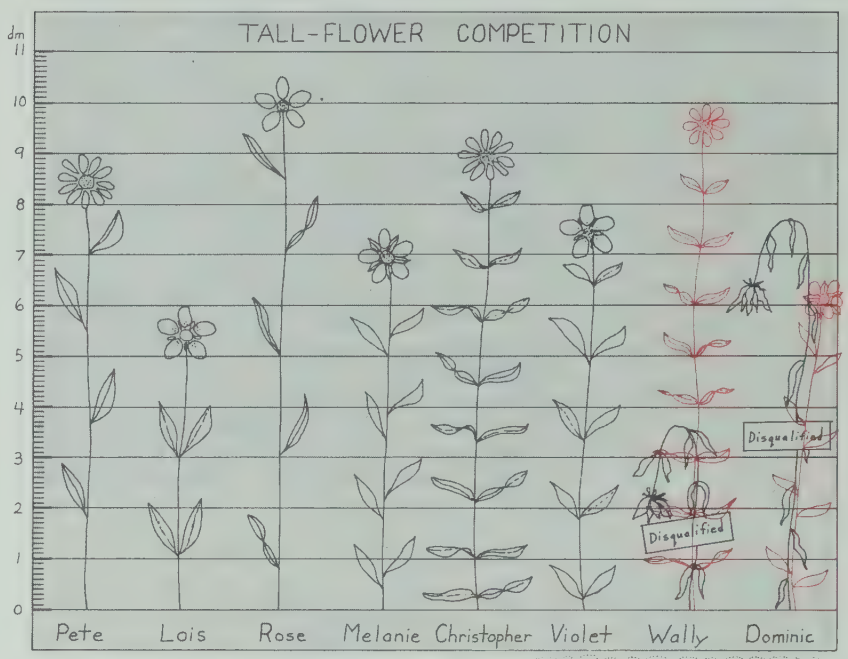
Checking Prerequisite Skills

Copy and complete the chart.

1.	102 cm	10.2 dm	1.02 m
2.	95 cm	9.5 dm	0.95 m
3.	60 cm	6.0 dm	0.60 m
4.	23 cm	2.3 dm	0.23 m

Graphing

The graph shows one result in the flower-growing contests.



The numbers on the scale show decimetres. The little marks show centimetres.

Rose's flower is the tallest. It is 10.5 dm or 105 cm tall.

Working Together

Answer these questions.

1. Who grew the second tallest flower? How tall is it? Christopher 9.5 dm
2. Who grew the shortest flower shown? How tall is it? Lois, 6 dm
3. How much taller than Violet's flower is Rose's flower? 2.5 dm
4. How much shorter than Pete's flower is Melanie's flower? 1.5 dm
5. How many flowers are taller than Melanie's? 4
6. How many flowers are shorter than Christopher's? 4

214

LESSON ACTIVITY

Using the Pages

- In Unit 7, students drew bar graphs and pictographs to display information. The bar graphs in this lesson involve scales marked to represent a unit of length such as the centimetre. To draw a graph, students may need to express metres, for instance, in terms of centimetres.

  Begin with a discussion of the graph shown on page 214. Have students note the title of the graph, and have them suggest other possible categories for a flower-growing contest, for example, the shortest flower, the widest flower, the best specimen of a particular flower. Ask how many entries there were for each category. Point out that the graph shows not only which flower is tallest (or shortest) but also how tall each flower is. Have students explain how the scale enables them to determine the height of each flower. Ask what numbers would take the place of 1, 2, 3, . . ., 11 if the scale were marked in centimetres. Read the statement regarding Rose's flower. Students may wish to place a straight edge on the graph to see that the of Rose's flower matches the point for 10.5 dm on scale. Discuss what is meant by "disqualified" and h students suggest why Wally's and Dominic's flowers w disqualified.

Working Together: Ex. 1 and 2 deal with interpreting the sc of the graph. Ex. 3 and 4 involve subtracting numb obtained from the graph. Ex. 5 and 6 involve interpret the graph without the use of the scale. Use other sim exercises as needed.

Exercises: Provide the students with tracing paper for Ex. 1 2. These exercises will familiarize them with drawin length to a particular scale, and will assist them in order the heights for Ex. 3. A straight edge placed across graph at the top of each flower is helpful in reading height on the scale. For Ex. 4, since the numbers wh sprouted are multiples of 2, each picture can represen flowers. (If students have forgotten how to prepare pictograph, refer them to page 166 and review the m aspects with them.) For Ex. 5, students may draw b

Exercises

The judges allowed Wally and Dominic to replace their wilted flowers with others.

1. Use tracing paper and draw Wally's new flower. It is 1 m tall. See page 214.

2. Use tracing paper and draw Dominic's new flower. It is 6.5 dm tall. See page 214

4.

CONTESTANT	NUMBER OF SEEDS SPROUTED
Pete	
Lois	
Rose	
Melanie	
Christopher	
Violet	
Wally	
Dominic	

EACH PICTURE STANDS FOR 2 SEEDS SPROUTED.

Each contestant in the flower-growing contest started with 24 seeds. They filled in this chart to show how many sprouted and bloomed.

	Sprouted	Bloomed	Shortest Flower Grown
Pete	22	18	60 cm
Lois	16	15	45 cm
Rose	12	9	0.30 m
Melanie	20	18	0.5 m
Christopher	16	12	5 dm
Violet	22	15	30 cm
Wally	8	6	25 cm
Dominic	18	12	50 cm

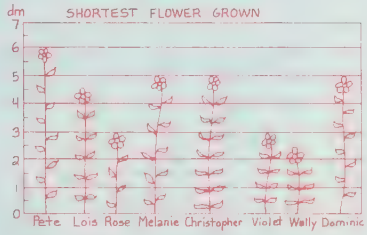
3.

Position	Name	Flower Height cm	dm	m
Second	Wally	100	10	1
Third	Christopher	95	9.5	0.95
Fourth	Pete	90	9	0.9
Fifth	Violet	80	8	0.8
Sixth	Melanie	75	7.5	0.75
Seventh	Dominic	65	6.5	0.65
Eighth	Lois	60	6	0.6

3. With Wally's and Dominic's new flowers in the contest, copy and complete this chart.

Position	Name	Flower Height cm	dm	m
First	Rose	105	10.5	1.05
Second				

6.



4. Draw a pictograph that shows the number of seeds that sprouted for each contestant.

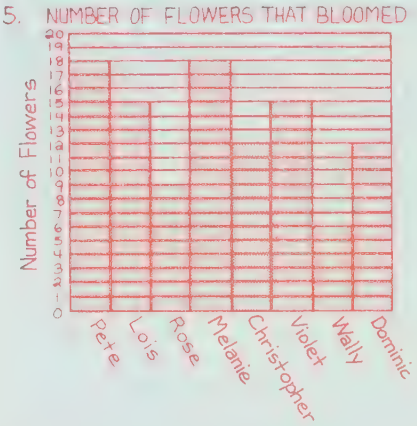
5. Draw a bar graph that shows the number of flowers that bloomed for each contestant. Answer is shown at the right.

6. Sketch a graph like the one on page 214 to show the shortest flower grown by each contestant.

RELATED ACTIVITIES

- Students may draw a pictograph for information gathered over a period of one month, such as the number of sunny days, cloudy days, and rainy days in the month.
- Students may help one another to measure their heights in centimetres. The result may be used in a bar graph to show the number of students whose heights are, for example, from 1.00 m to 1.09 m, from 1.10 m to 1.19 m, from 1.20 m to 1.29 m, and so on.

5.



2.

Contestants in Each Competition	
Tallest flower	
Shortest flower	
Widest flower	
Best sunflower	
Best rose	

Each ♀ represents 2 persons

rather than flowers. Note that Ex. 6 will require the students to decide which unit is best for marking the scale and to express lengths in terms of that unit for graphing. Have them draw their graphs for Ex. 5 and 6 on copies of page T 367 or page T 368.

sessment

Draw a bar graph that shows the heights of these people.

Pete	13.1 dm
Melanie	1.40 m
Rose	12 dm
Wally	146 cm
Lois	138 cm

Draw a pictograph that shows how many people entered each competition.

Tallest flower	8
Shortest flower	8
Widest flower	12
Best sunflower	16
Best rose	4

1.

Pages 216-217

LESSON OUTCOME

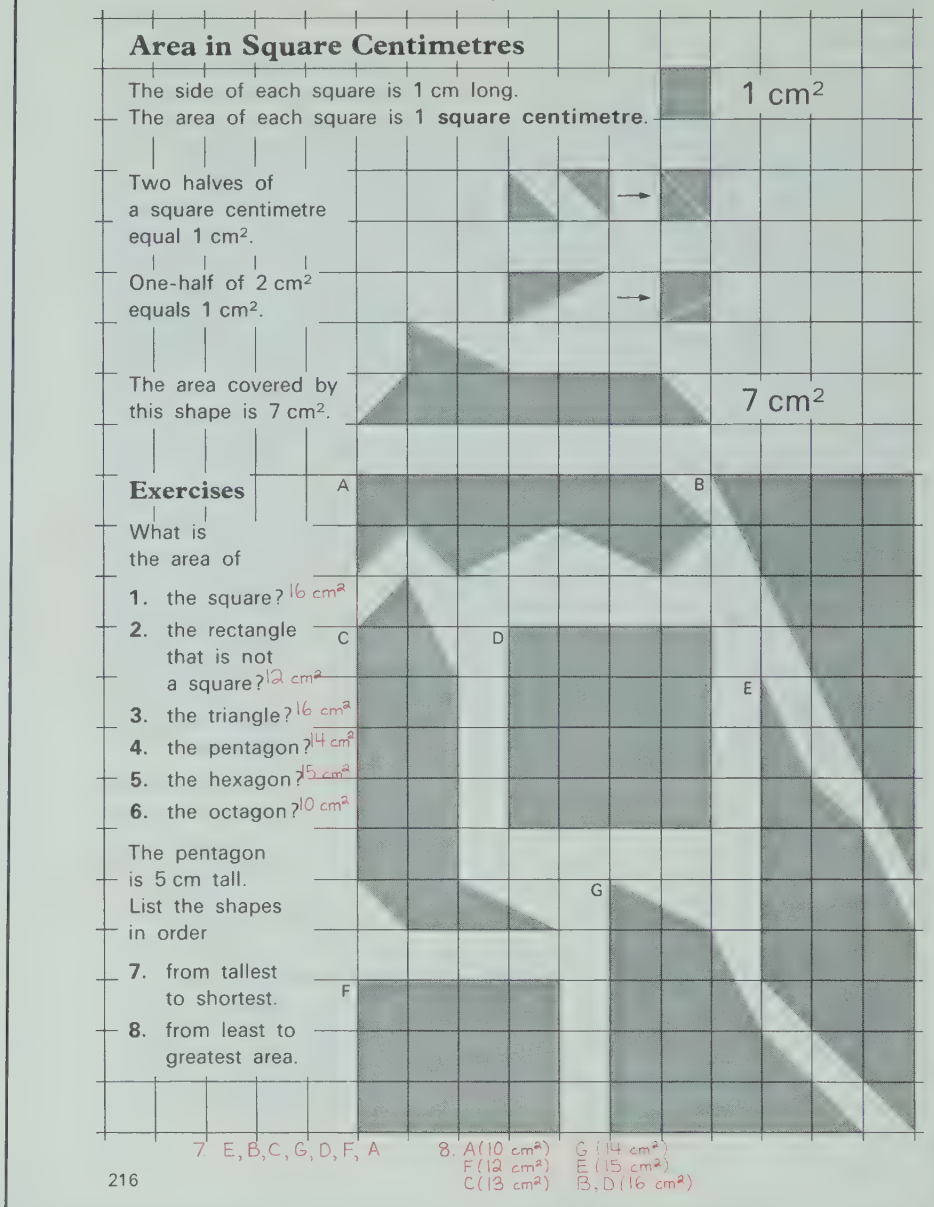
Find area in square centimetres by counting whole units and half units

Materials

two rectangular pieces of paper 4 cm by 7 cm and 20 cm by 30 cm; overhead projector, centimetre grid transparency, transparency showing two unmarked rectangles 4 cm by 7 cm and 5 cm by 6 cm or cutouts of rectangles 4 cm by 7 cm and 5 cm by 6 cm, centimetre grid transparency; centimetre rulers; centimetre graph paper (use copies of page T 367)

Vocabulary

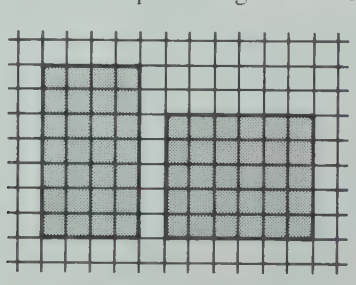
area, square centimetre, cm^2


Area in Square Centimetres
The side of each square is 1 cm long.
The area of each square is 1 square centimetre.
1 cm²
Two halves of a square centimetre equal 1 cm².
One-half of 2 cm² equals 1 cm².
The area covered by this shape is 7 cm².
7 cm²
Exercises
What is the area of
1. the square? 16 cm²
2. the rectangle that is not a square? 12 cm²
3. the triangle? 16 cm²
4. the pentagon? 14 cm²
5. the hexagon? 15 cm²
6. the octagon? 10 cm²
The pentagon is 5 cm tall. List the shapes in order
7. from tallest to shortest.
8. from least to greatest area.
A
B
C
D
E
F
G
7 E, B, C, G, D, F, A
8. A(10 cm²) G(14 cm²)
F(12 cm²) E(15 cm²)
C(13 cm²) B, D(16 cm²)
216

LESSON ACTIVITY

Before Using the Pages

- Introduce a situation that involves the concept of area. Display two rectangular pieces of paper (4 cm by 7 cm and 20 cm by 30 cm). Ask which has more surface on which to draw a picture, write a letter, or color a map. The answer will be obvious. Then use the following suggestions with an overhead projector and transparencies or with cutouts. Present two rectangular shapes, 4 cm by 7 cm and 5 cm by 6 cm. Discuss which shape is longer and which is wider.



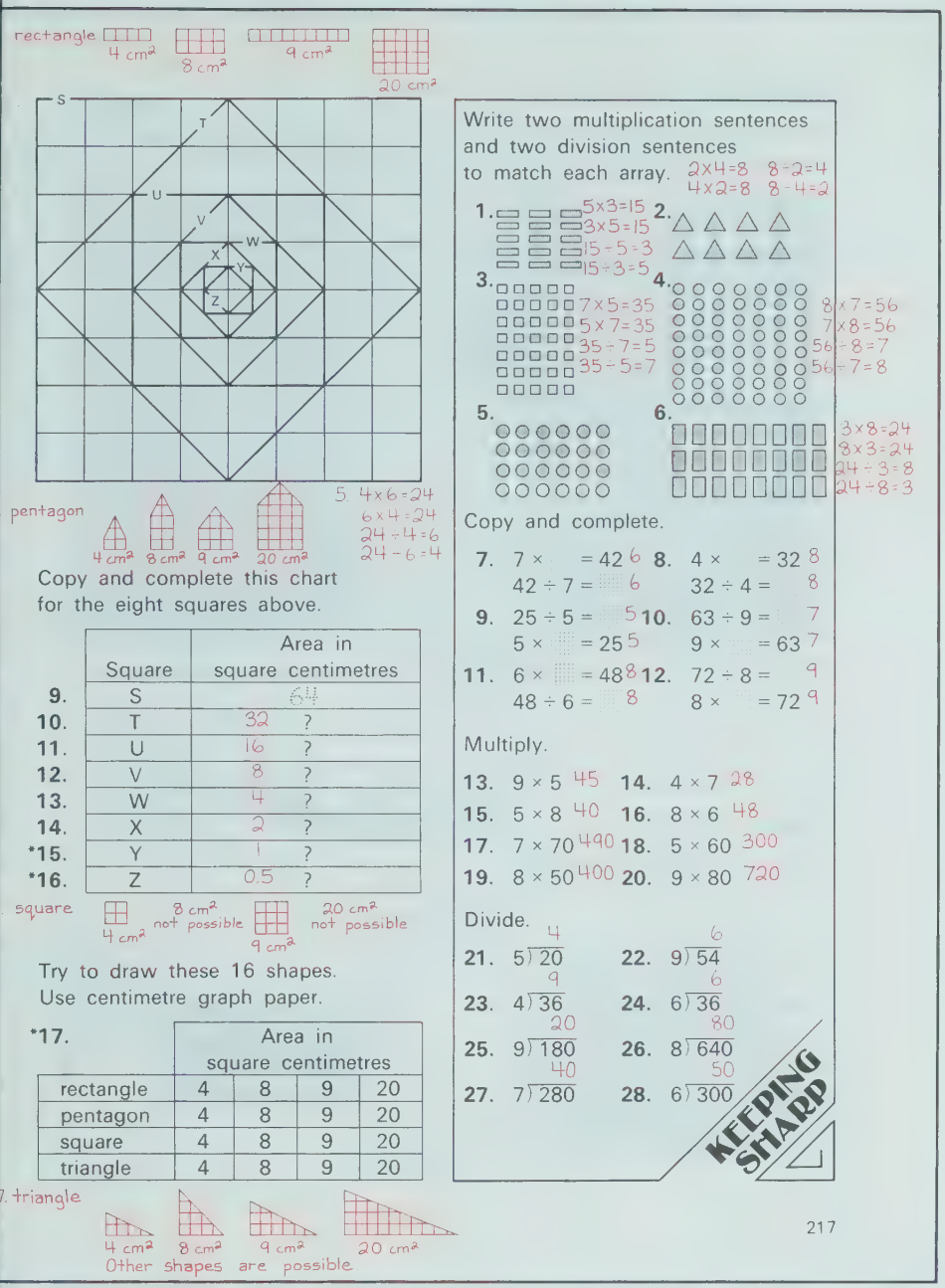
Then ask which has more surface. There will likely considerable debate. At an appropriate point in t students' discussion, place the centimetre grid transparen over each rectangle, matching grid lines with sides. Ask t students if this helps them to reach a conclusion.

Using the Pages

- The concept of area is presented as the number of square un covered by a shape. The unit of measure is the squa centimetre.

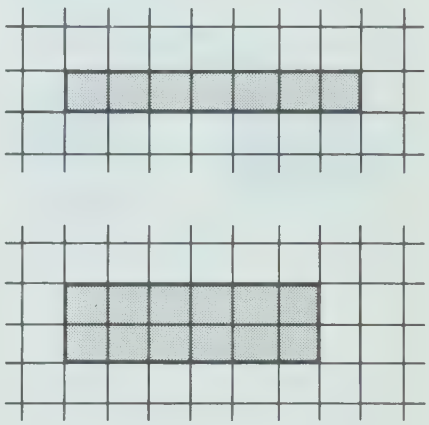
  Have the students observe that the grid lines on page 2 form squares. Have them use their centimetre rulers check that the small squares have sides 1 cm long. Th read the statements at the top of the page, and associate t term *1 square centimetre* with the first red square. Ha them identify the symbol cm^2 as the short way of writi the term *square centimetre*. Emphasize the size and t position of the numeral 2.

  Develop that 1 cm^2 can be associated with two halves one square and with one-half of two squares.



RELATED ACTIVITIES

- Have students trace around various objects on centimetre graph paper. Have them count the centimetre squares to obtain an approximate measure of the area traced.
- Have students use rulers to draw shapes by following grid lines on centimetre graph paper. Have them draw and color inside as many rectangular shapes as possible having an area of 16 cm², for example. Have them complete a chart to show the perimeter of each shape having an area of 16 cm². Ask which shape has the least perimeter. (The shape should be a square.)
- Have students draw rectangular shapes as in the preceding activity (following grid lines) so that each shape has a perimeter of, for example, 16 cm. Ask which shape has the greatest area. (The shape should be a square.)



Have the students determine the area covered by the last shape. Have a few students explain the procedure they used. (Perhaps whole squares were counted first and then parts of squares, or vice versa.) Summarize that the area of a shape can be found by counting the squares covered by the shape (square centimetres in this lesson).

Exercises: Students who cannot recall the number of sides associated with the polygons named in Ex. 1-6 should refer to page 82. Ex. 7 and 8 demonstrate that the "tallest" shape does not necessarily have the greatest area. They also demonstrate that different shapes may have the same area (B and D).

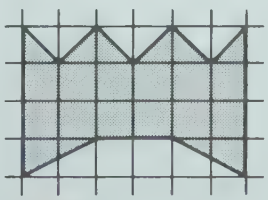
The answers for Ex. 9-16 will form a pattern. Ex. 15 and 16 are starred as their answers are not readily determined from the diagram. Students who recognize that there is a pattern in the answers for Ex. 9-14 can continue the pattern to obtain answers for Ex. 15 and 16.

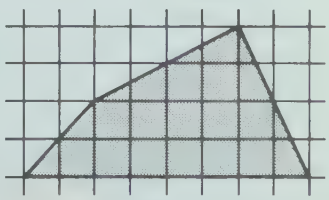
Provide students with copies of page T 367 on which to show the shapes for Ex. 17. Note that it is not possible to draw some shapes using centimetre squares, for example, a square having an area of 8 cm² or 20 cm².

Keeping Sharp: These exercises help to maintain an understanding of the concepts of multiplication and division and the skills associated with them. These skills will be applied in the following lesson.

Assessment

Find the area of each shaded region. Each square represents 1 cm².

1. 
17 cm²

2. 
18 cm²

Pages 218-219

LESSON OUTCOME

Use multiplication to find the area of a rectangular shape in square centimetres

Materials

centimetre graph paper (use copies of page T 367), rulers

Prerequisite Skills

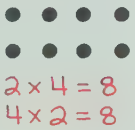
Write a multiplication sentence for an array; find area in square centimetres by counting whole units

Checking Prerequisite Skills

Write two multiplication sentences to match each array.

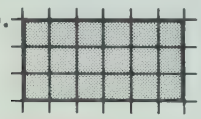
1.

$3 \times 6 = 18$
$6 \times 3 = 18$

2. 

$2 \times 4 = 8$
$4 \times 2 = 8$

Find the area of each shaded region. Each square represents 1 cm^2.

3. 

18 cm^2

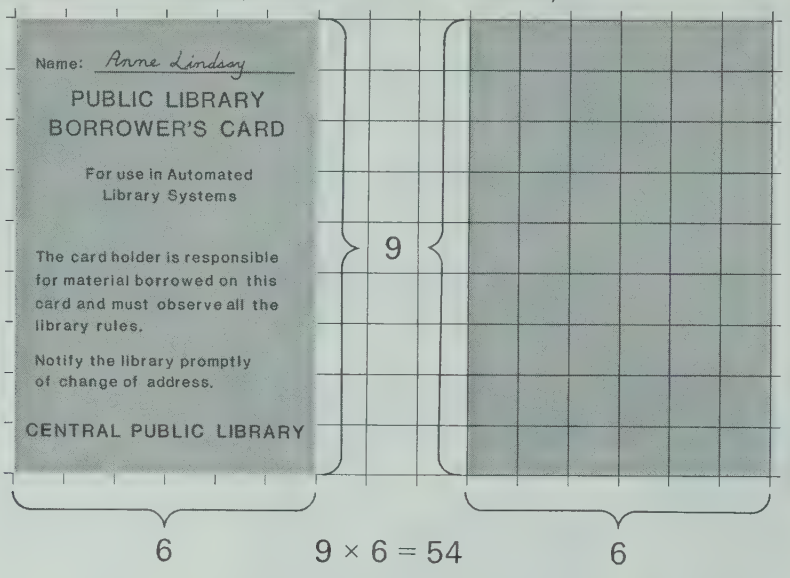
4.

8 cm^2

Using Multiplication to Find Area

The square centimetres that match a rectangle form an array.

Multiplication tells how many are in an array.


Name: Anne Lindsay
PUBLIC LIBRARY
BORROWER'S CARD
For use in Automated Library Systems
The card holder is responsible for material borrowed on this card and must observe all the library rules.
Notify the library promptly of change of address.
CENTRAL PUBLIC LIBRARY
9
6
6

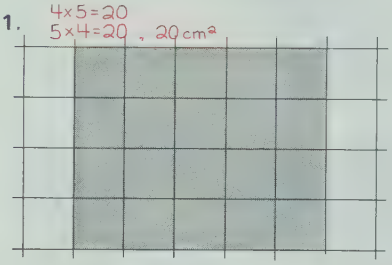
$9 \times 6 = 54$

$6 \times 9 = 54$

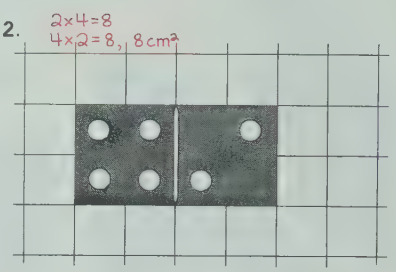
There are 54 cm^2 covered by the library card.

Working Together

Write two multiplication sentences that give you the area of each of these.

1. 

$4 \times 5 = 20$
$5 \times 4 = 20$, 20 cm^2

2. 

$2 \times 4 = 8$
$4 \times 2 = 8$, 8 cm^2

218

LESSON ACTIVITY

Using the Pages

- Review that the number of square centimetres covered by a shape gives the area of the shape. Have the students study the illustration of the library card and name the shape of the card. Discuss that the area of the card can be obtained by finding the number of square centimetres covered by the card. Point out the illustration that shows the centimetre grid lines on the card. Ask how many rows of centimetre squares there are and how many are in each row. Ask how many columns of centimetre squares there are and how many are in each column. Ask for a quick way to find the number of square centimetres in all. Discuss that two multiplication sentences are possible to obtain this number.

  If grid lines do not appear on a rectangle, an array can be imagined. If the dimensions are given in centimetres for both the length and the width, they tell how many are in each row and the number of rows, and multiplication of these two numbers can be used to find the area.

Working Together: Ex. 1 shows an array of centimetre squa on the rectangular shape. Ask how many rows and h many columns of centimetre squares there are. For Ex. the shape is not marked to show the centimetre grid lin Have students explain how they know what numbers are be multiplied.

Exercises: The illustrations for Ex. 1-5 represent rectangu packets from restaurants. Since there are no square pack in these examples, there will be two multiplicati sentences for each.

Provide the students with copies of page T 367 on whi to draw their rectangles for Ex. 6-13. Have them use th rulers in drawing the shapes. Ex. 6-9 help students associate the product in a multiplication with the area o rectangle. Ex. 10-13 help them to associate the missi factor in a multiplication with the length of one side o rectangle. You may wish to discuss that the shapes in Ex and 13 are square and review that a square is a "specia rectangle.

Exercises

Write two multiplication sentences that give the area of each of these.

1.

2. 3×2=6
2×3=6, 6 cm²

3.

4×3=12
3×4=12, 12 cm²

4. SALT

5.

Use centimetre graph paper. Draw a rectangle for each of these. Then, complete the multiplication sentence.

6. 3 × 6 = ▦ 18
7. 4 × 7 = ▦ 28
8. 4 × 4 = ▦ 16
9. 8 × 5 = ▦ 40
10. 5 × ▦ = 15 3
11. 3 × ▦ = 24 8
12. 4 × ▦ = 20 5
13. 6 × ▦ = 36 6

Answers for Ex 6-13 are shown at the right.

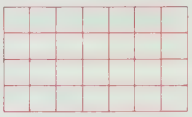
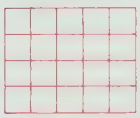
Multiply, divide, add, or subtract.

1. 436 + 217 653
2. 6 × $30 $180
3. 2000 − 532 1468
4. $43.15 + $3.85 $47.00
5. 270 ÷ 9 30
6. $1.95 + $0.53 $2.48
7. $114 − $97 $17
8. 5 × 682 3410
9. 38 + 28 66
10. $3.02 − $2.76 $0.26
11. 200 ÷ 5 40
12. $128 + $75 $203
13. 6 × $7.04 $42.24
14. $2836 + $4379 $7215
15. 4460 − 2586 1874
16. $6.31 − $1.73 $4.58
17. 7 × 58 406
18. 5472 + 496 5968
19. $49 − $26 $23
20. $720 ÷ 8 $90
21. 9 × 70 630
22. 300 ÷ 6 50
23. 785 − 357 428
24. 4 × $90 $360
25. 490 ÷ 7 70
26. $37.42 − $31.80 $5.62
27. 9 × $594 $5346
28. $240 ÷ 3 $80
29. 8 × 60 480

KEEPING SHARP

RELATED ACTIVITIES

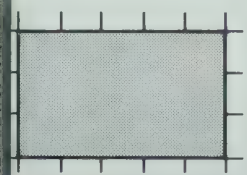
- Have students bring rectangular labels from cans and bottles to school. Some labels may be trimmed so that their edges match a whole number of centimetres. The labels may be pasted on individual sheets of centimetre graph paper. The students may use multiplication to find the area of each label.
- Have students measure the edges of various small, rectangular shapes, such as library book cards, envelopes, soda biscuits, and lids of various boxes. Have them use multiplication to find the area of each shape.
- You may wish to have students investigate the concept of area, using tangrams as described on page T 346.

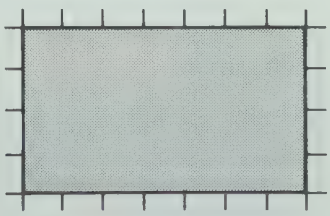
6.
7. 
8.
9.
10.
11.
12. 
13.

Keeping Sharp: These exercises help to maintain the skills in the four basic operations. Since the exercises are not grouped according to operations, the students will have to pay close attention to the operation required in each exercise. Remind them that most of the exercises will have to be written in vertical form.

Assessment

Write two multiplication sentences that give the area of each of these.

1. 
5 × 5 = 15
5 × 3 = 15

2. 
4 × 7 = 28
7 × 4 = 28

Use centimetre graph paper. Draw a rectangle for each of these. Then, complete the multiplication sentence.

3. 4 × 6 = ▦ 24

4. 5 × ▦ = 20 4

Page 220

LESSON OUTCOME

Use multiplication to find the area of a rectangular shape in square decimetres and in square metres

Materials

a centimetre square, several decimetre squares (use copies of page T 363), metre sticks

Vocabulary

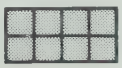
square decimetre, dm^2, square metre, m^2

Prerequisite Skills

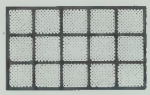
Use multiplication to find the area of a rectangular shape

Checking Prerequisite Skills

Write two multiplication sentences that give the area of each of these.

1. 

$2 \times 4 = 8$
$4 \times 2 = 8$

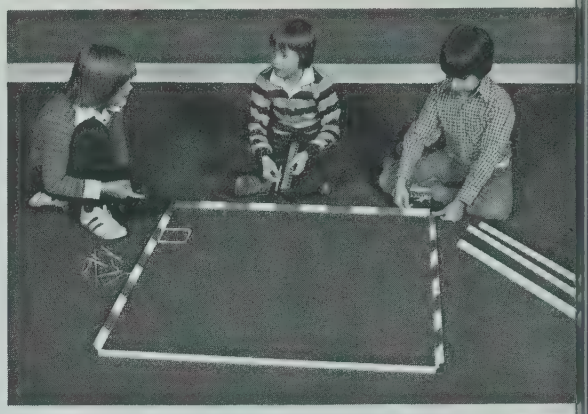
2. 

$3 \times 5 = 15$
$5 \times 3 = 15$

RELATED ACTIVITIES

- Have students cover various surfaces, such as the sides of a box, using decimetre squares. Have them find the area of each side in square decimetres.
- Have students draw floor plans for rooms by following the grid lines on centimetre graph paper. Have them give the area of each room if each square represents 1 m^2.

Area in Square Decimetres and Square Metres



The small square shows a **square decimetre.**

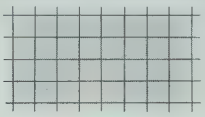
1 dm^2

The large square shows a **square metre.**

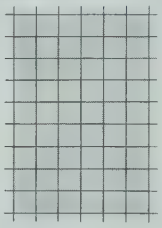
1 m^2

Exercises

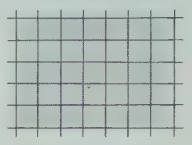
If each square represents 1 dm^2, what is the area of each of these?

1. 

32 dm^2

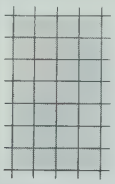
2. 

54 dm^2

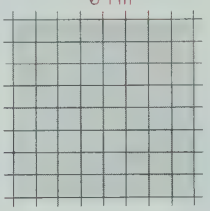
3. 

35 dm^2

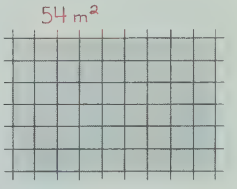
If each square represents 1 m^2, what is the area of each of these?

4. 

28 m^2

5. 

64 m^2

6. 

54 m^2

7. Look around. Name a shape that is about 1 dm^2 in size.
Answers will vary

8. Look around. Name a shape that is about 1 m^2 in size.
Answers will vary.

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LESSON ACTIVITY

Before Using the Page

- Discuss that the square centimetre is a small unit of measure for area and thus is awkward for measuring the area of a large surface such as a table, a door, or a floor. Have the students recall that certain units of length are more appropriate than others for measuring longer distances rather than shorter distances (see page 211). Suggest that squares larger than the centimetre square would be preferable for measuring areas of large surfaces. Some students may be able to suggest what square units these are.

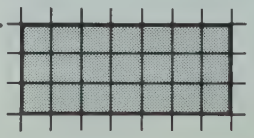
Using the Page

- Have a student read the statements to the left of the photograph. Draw attention to the symbols dm^2 and m^2. Discuss that each side of the decimetre square is 1 dm long, and each side of the metre square is 1 m long. Have the students note that one side of the decimetre square in the photograph matches 1 dm (shown in red) on the me stick. Ask which unit is preferable for covering a lar surface such as a floor. Have students work in groups cover the surface of a desk using decimetre squares (c from copies of page T 363) and give the area to the near square decimetre. Arrange metre sticks on the floor or dra line segments on the board to enable students to visuali an area of 1 m^2.

Exercises: Emphasize that each square represents 1 dm^2 in E 1-3 and 1 m^2 in Ex. 4-6. Have students explain w multiplication can be used to find the area of each shap

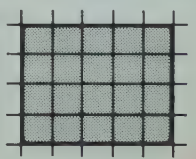
Assessment

Each square represents 1 dm^2. What is the area of the shape?

1. 

21 dm^2

Each square represents 1 m^2. What is the area of the shape

2. 

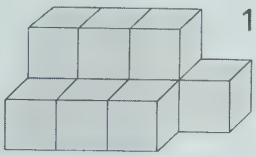
20 m^2

Volume in Cubic Centimetres

Each edge of the cube is 1 cm long.
The volume of the cube is 1 **cubic centimetre**.

1 cm^3

You can count cubic centimetres to find volumes of larger solids.

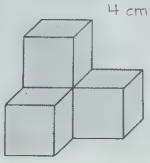


10 cm^3

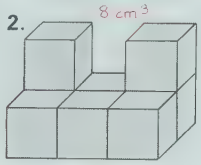
Exercises

Find the volume in cubic centimetres.

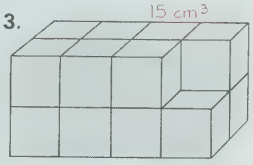
1. 4 cm^3



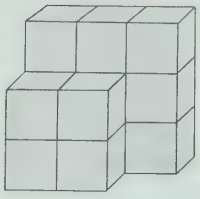
2. 8 cm^3



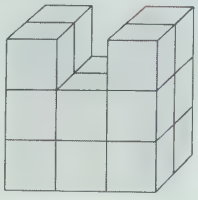
3. 15 cm^3



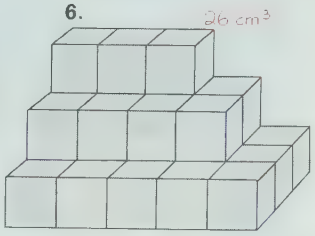
4. 13 cm^3



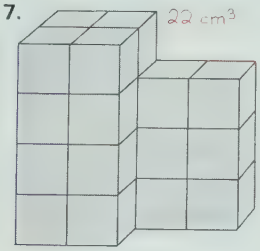
5. 16 cm^3



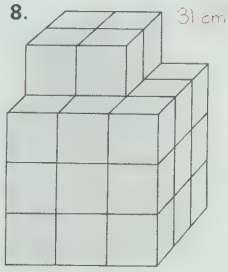
6. 26 cm^3



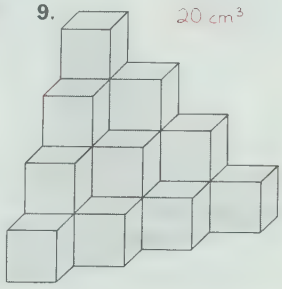
7. 22 cm^3



8. 31 cm^3



9. 20 cm^3



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Page 221

LESSON OUTCOME

Find volume by counting centimetre cubes

Materials

a square, a large cube, centimetre cubes, centimetre rulers

Vocabulary

volume, cubic centimetre, cm^3

RELATED ACTIVITIES

- Have students use centimetre cubes to show different shapes that have the same volume. For example, different shapes constructed from 16 centimetre cubes will each have a volume of 16 cm^3.
- Provide students with small containers such as jewelry boxes, paper clip holders, and pin boxes. Have them fill each container with centimetre cubes or copy each shape by building with centimetre cubes to obtain the size suggested by the container. The cubes may then be counted to give the volume of the original container.
- Students may judge which of two small boxes they think holds more centimetre cubes and then fill each box to check.

ESSON ACTIVITY

fore Using the Page

Display a square and a cube larger than a centimetre cube. Ask the students for ways they are alike. Then ask for ways they are different. Discuss that the square has length and width, whereas the cube has length, width, and height.

Display a centimetre cube beside the first cube. Ask for ways the two cubes are alike and ways they are different. Discuss that the larger cube occupies more space.

ing the Page

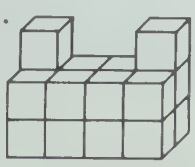
Give each student a centimetre cube. Discuss that the diagrams on the page suggest shapes built from cubes like the one they have been given. Have the students use their centimetre rulers to check that each edge of their cubes is 1 cm long. Then read the statements at the top of the page. Have the students associate the word *volume* with the amount of space occupied by a shape. Draw attention to the symbol cm^3, and in particular to the size and position of the numeral 3. Discuss that there are hidden cubes in the shape whose volume is 10 cm^3. You may wish to have students copy this shape using centimetre cubes. Summarize that the centimetre is a measure of length, the square centimetre is a measure of area, and the cubic centimetre is a measure of volume.

Exercises: Have students count the cubes to find the volume of each shape. Some students may need to build the structures in order to understand the position and the number of hidden cubes.

Assessment

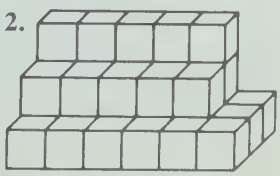
Each cube represents 1 cm^3. Find the volume in cubic centimetres.

1.



18 cm^3

2.



33 cm^3

Page 222

LESSON OUTCOME

Classify an object as smaller than, about the same size as, or larger than a decimetre cube; find volume by counting decimetre cubes

Materials

centimetre rulers, decimetre cubes

Vocabulary

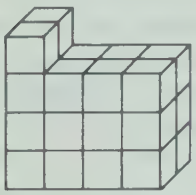
cubic decimetre, dm^3

Prerequisite Skills

Find volume by counting centimetre cubes

Checking Prerequisite Skills

Each small cube represents 1 cm^3. Find the volume in cubic centimetres.

1.  26 cm^3

RELATED ACTIVITIES

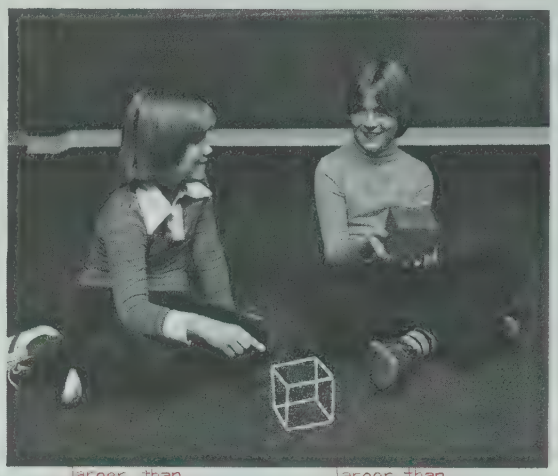
- Have students construct decimetre cubes using decimetre squares cut from copies of page T 363. Six squares are taped to form a net (one pattern is shown on page T 357), and the net is folded and taped to form a cube. For a more durable cube, have students paste the squares to cardboard and cut the cardboard to shape.

Volume in Cubic Decimetres

A **cubic decimetre** looks like this.

1 dm^3

Each edge of the cube is 1 dm long.

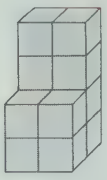
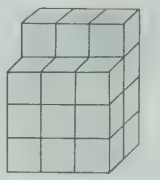
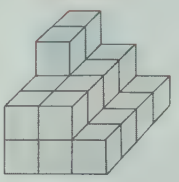


Exercises

Is it smaller than, about the same size as, or larger than a cubic decimetre?

1. your two fists — smaller than
2. your head — larger than
3. half a loaf of bread — larger than
4. a mailbox — larger than
5. a grapefruit — about the same size as
6. a basketball — larger than

If each little cube represents 1 dm^3, what is the volume of each solid?

7. 12 dm^3 
8. 21 dm^3 
9. 22 dm^3 

Look around. Name any item with volume that seems to be Answers will vary for Ex 10-12.

10. less than 1 dm^3.
11. about 1 dm^3.
12. greater than 1 dm^3.

Choose the best estimate for

13. the number of cubic centimetres in a cubic decimetre.

10, 100, 1000, or 10 000

1000

222

LESSON ACTIVITY

Before Using the Page

- Display several centimetre cubes. Discuss that constructing a large shape using centimetre cubes would take a long time and would require many cubes. Suggest that a cube larger than the cubic centimetre would be preferable.

Using the Page

- Have the students study the photograph and read the statements to introduce 1 dm^3. Point out how the model built from straws and pipe cleaners shows the edges of the decimetre cube more clearly than the plastic model.

  Provide the students with decimetre cubes and have them use their rulers to check that each edge is 1 dm long (10 cm = 1 dm). Have groups of students arrange their decimetre cubes to form a shape and give the volume in cubic decimetres.

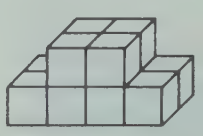
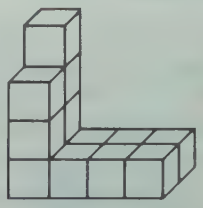
Exercises: You may wish to discuss a few of these orall Remind the students to use the symbol dm^3 in their answe to Ex. 7-9. Some students may need to use centimet cubes and a decimetre cube to check their estimate for E 13.

Assessment

Is it smaller than, about the same size as, or larger than a cub decimetre?

1. a box of crayons — smaller than
2. a tub of ice cream — about the same size

If each small cube represents 1 dm^3, what is the volume of ea solid?

3.  12 dm^3
4.  13 dm^3

Volume in Cubic Metres

A **cubic metre** looks like this.

1 m^3

Each edge of the cube is 1 m long.

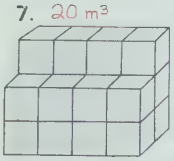
Exercises

Is it smaller than, about the same size as, or larger than a cubic metre?

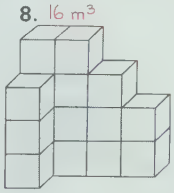
1. a television set — smaller than
2. an automobile — larger than
3. the teacher's desk — larger than
4. a bale of hay — smaller than
5. the solid suggested by a card table — about the same size as
6. the school trash bin — Answers will vary

If each little cube represents 1 m^3, what is the volume of each solid?

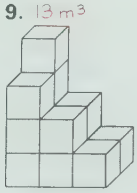
7. 20 m^3



8. 16 m^3



9. 13 m^3



Look around. Name any item with volume that seems to be Answers will vary for Ex. 10-12.

10. less than 1 m^3.
11. about 1 m^3.
12. greater than 1 m^3.

Choose the best estimate for

13. the number of cubic decimetres in a cubic metre.

10, 100, 1000, or 10 000

1000

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Page 223

LESSON OUTCOME

Classify an object as smaller than, about the same size as, or larger than a metre cube; find volume by counting metre cubes

Materials

centimetre cubes, decimetre cubes

Vocabulary

cubic metre, m^3

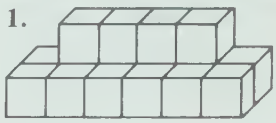
Prerequisite Skills

Find volume by counting decimetre cubes

Checking Prerequisite Skills

If each small cube represents 1 dm^3, what is the volume of this solid?

1. 16 dm^3



RELATED ACTIVITIES

- Metre sticks that can be joined together to form a metre cube may be purchased. If you do not have access to these, you may wish to mark an area of 1 m^2 on the floor in one corner of the room and on the two adjoining walls. Students may stand on the vertex opposite the corner and hold two metre sticks to complete the shape of a metre cube.

ESSON ACTIVITY

fore Using the Page

Review that the volume of a solid can be found by counting centimetre cubes or decimetre cubes. Ask which shape would be larger, one whose volume is 6 cm^3 or one whose volume is 6 dm^3. (Demonstrate such shapes using the appropriate cubes, if necessary.) Suggest that a cube larger than 1 dm^3 would be needed to measure the volume inside a panel truck, for example. Some students may be able to suggest the dimensions of such a cube.

ing the Page

Read the statements to introduce the cubic metre. Have the students note the difference in size of the decimetre cube and the metre cube in the photograph. Discuss that the metre stick held by the boy in the photograph helps to show that the height of the cube is 1 m. Ask what the red and white markings represent.

Exercises: It would be beneficial to carry out a discussion of students' answers to Ex. 1-6 and 10-13. Emphasize in Ex. 7-9 that each small cube represents 1 m^3.

Assessment

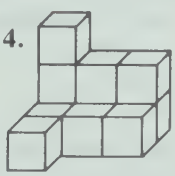
Is it smaller than, about the same size as, or larger than a cubic metre? Answers may vary.

1. a washing machine — about the same size
2. a refrigerator — larger than

If each small cube represents 1 m^3, what is the volume of each solid?

3. 12 m^3

4. 11 m^3



Page 224

OBJECTIVE

Construct models to help solve problems

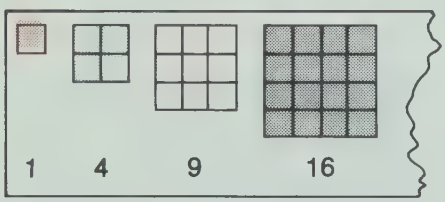
Materials

centimetre cubes or other suitable cubes for each child

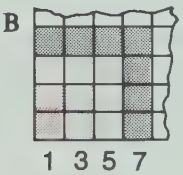
RELATED ACTIVITIES

- Models showing various solutions to problems on this page may be displayed and referred to in a discussion of the exercises.
- Students may color squares on centimetre graph paper to show the smallest square, the next largest square array, and so on, for several consecutive square arrays (A). These may be cut and stacked, overlapping as illustrated (B), to demonstrate the number of squares for consecutive arrays.

A



B

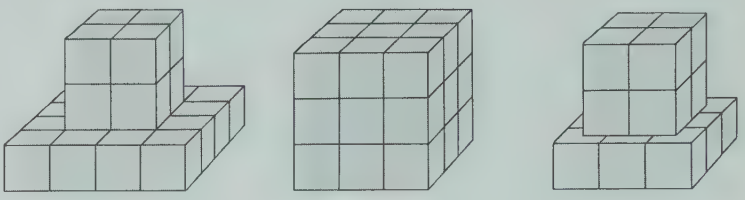


Working with Models

How many blocks are needed for a stack with three layers so that each layer suggests a square array?

Solutions are easy to find if you make models to match the problem.

Here are three solutions.



24 blocks 27 blocks 17 blocks

Use blocks to help you solve each problem.

1. 16 blocks are placed to form a square array. How many more blocks are needed to form the next largest square array? 9
2. 27 blocks are stacked to form a cube. How many more blocks are needed to form the next largest cube? 37
3. How many blocks are needed to surround one block (on all sides and at all corners)? 26
4. How many blocks are needed to surround two blocks (on all sides and at all corners)? 34
5. The class needs to build a model having a volume of 24 dm³. Show 3 different shapes for the model. Answers will vary.
6. The school needs a small building having room for 18 m³. Show 3 different shapes for the building. Answers will vary.
7. Stack 18 blocks in layers. Multiply the number of blocks in the first layer by 1, the number in the second layer by 2, and so on. Add all the products. What stacking gives the greatest sum? One block in each layer
8. Build "pyramids" → with blocks. Make a chart like this and fill it in. After you fill in 5 or 6 rows, try to guess this entry → without building any more pyramids.

Layers	Blocks needed
1	1
2	3
3	6
4	?10
10	?55

PROBLEM SOLVING

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Layers	Blocks needed
5	15
6	21
7	28
8	36
9	45

LESSON ACTIVITY

Using the Page

- These exercises illustrate the kinds of problems that may be awkward or difficult to solve using just paper and pencil. Building a model to illustrate and help solve a problem is an important problem-solving strategy.

  Read the problem carefully to the students. Have each of three students explain why the diagrams shown meet the conditions of the problem. Have the students use their own cubes to copy each solution and then to find solutions of their own. Emphasize the value in constructing models to help solve problems.

  For Ex. 1-8, you may wish to have the students work in pairs to help one another read and interpret the problems and compare solutions. You may wish to have the students work on these exercises over several days.

Checking Up

Use a centimetre ruler.
Measure each line segment.

1. 10 cm

2. 4 cm

3. 15 cm

Copy and complete each sentence.

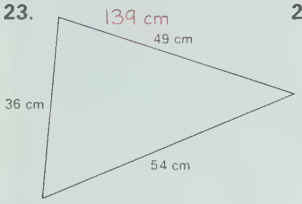
4. 287 cm = ▒ m 2.87
5. 12 dm = ▒ m 1.2
6. 1 dm = ▒ cm 10
7. 1.25 m = ▒ cm 125
8. 2 km = ▒ m 2 000
9. 7 cm = ▒ dm 0.7
10. 1 m = ▒ dm 10
11. 4000 m = ▒ km 4
12. 35 dm = ▒ cm 350
13. 0.6 m = ▒ cm 60
14. 1 km = ▒ m 1000
15. 3 m = ▒ dm 30
16. 100 cm = ▒ m 1
17. 40 cm = ▒ m 0.4
18. 18 km = ▒ m 18 000

Which unit, the centimetre, the metre, or the kilometre would be best for measuring these?

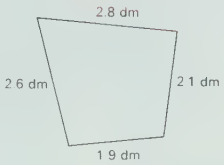
19. a fishing line metre
20. a match stick centimetre
21. from one town to the next kilometre
22. from your school to the street metre

Find the perimeter of each shape.

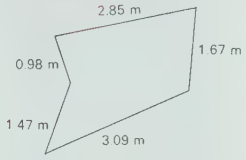
23. 139 cm



24. 9.4 dm



25. 10.06 m



Solve.

26. The sides of a pentagon measure 15 cm, 17 cm, 22 cm, 18 cm, and 27 cm. What is the perimeter of the pentagon? 99 cm

27. What is the perimeter of a square that has one side 8 m long? 32 m

Checking Up continues on next page.

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

Materials

centimetre ruler and centimetre graph paper (see page T 367) for each student

lls	Exercises	Related Pages
asure length in centimetres	1-3	T 220-T 221
press a length given in one unit of measure in terms of another unit of measure	4-18	T 222-T 226
ose the preferred unit of length	19-22	T 227
d the perimeter of a shape	23-25, 28, 29	T 228-T 229
w a bar graph	30	T 230-T 231
d the area of a shape in square centimetres	31, 32	T 232-T 235
d the volume of a shape in cubic centimetres	33, 34	T 237
ve word problems related to perimeter	26, 27	T 228-T 229

Comments

Remind the students that there are two pages for *Checking Up*. Provide each student with a centimetre ruler for Ex. 1-3, 28, 29, and a sheet of centimetre graph paper for Ex. 30. If errors occur in Ex. 28 and 29, students may not be aligning their rulers correctly for each line segment.

Students having difficulty converting among measures in Ex. 4-18 should refer to the equivalents at the top of pages 208 and 210.

For Ex. 30, note whether students include appropriate headings and scale, and whether the days of the week are shown in order.

RELATED ACTIVITIES

- Have students make a chart and use a check to show the preferred unit of measure for exercises similar to the following.

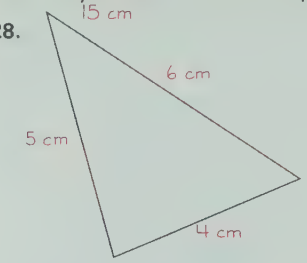
Area of	cm^2	dm^2	m^2
the classroom			✓
the floor			
a sheet of paper			
the display board			
my bedroom			
a playing card			

- Adapt the preceding activity for volume.

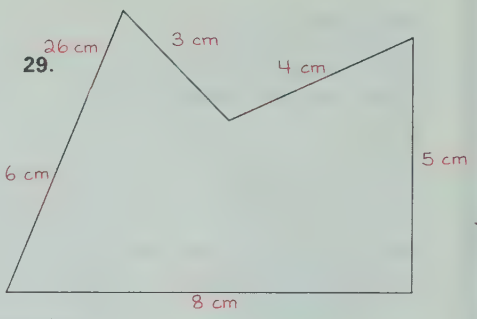
Volume of	cm^3	dm^3	m^3
a jewelry box	✓		
an aquarium			
a cereal box			
the gymnasium			

Use a centimetre ruler and find the perimeter of each shape.

28.



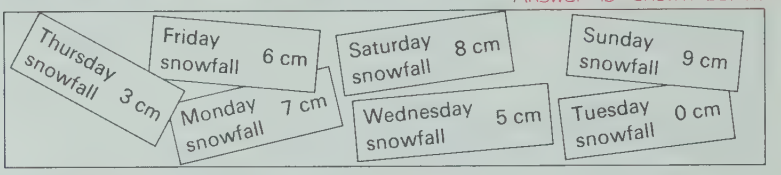
29.



Draw a bar graph that shows this information.

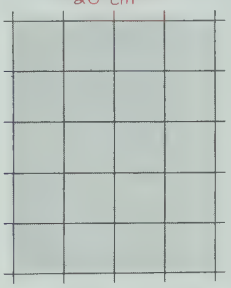
Answer is shown below.

30.

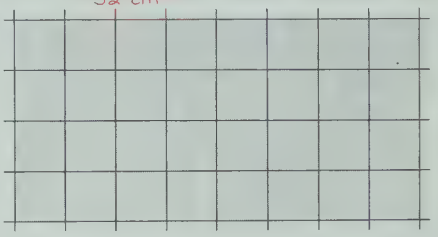

Thursday snowfall 3 cm
Friday snowfall 6 cm
Monday snowfall 7 cm
Saturday snowfall 8 cm
Wednesday snowfall 5 cm
Sunday snowfall 9 cm
Tuesday snowfall 0 cm

Give each area in square centimetres.

31. 20 cm^2

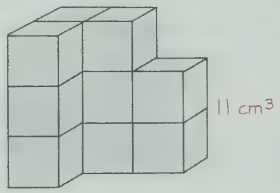


32. 32 cm^2

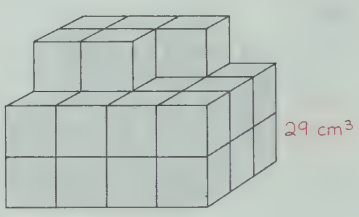


Give each volume in cubic centimetres.

33.



34.



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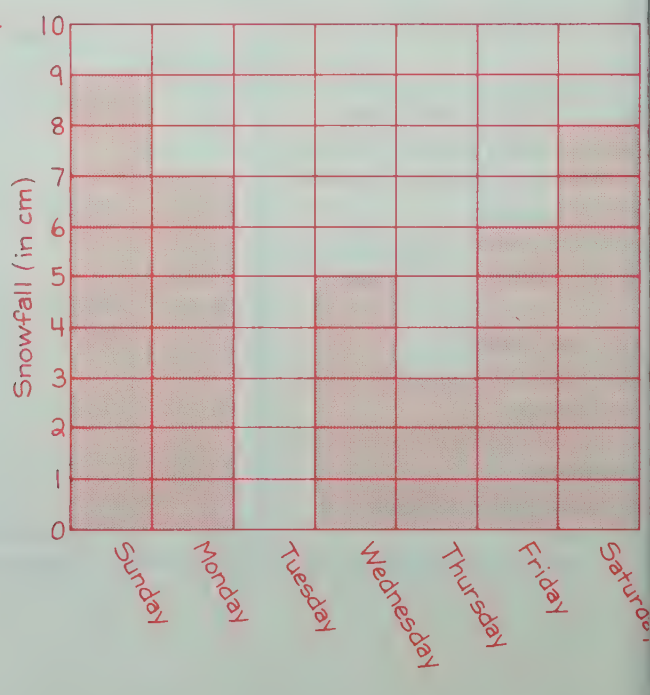
30.



Checking Skills

Add.

1. 34.6 + 3.4 = 38.0
2. 60.72 + 13.94 = 74.66
3. 1.78 + 5.37 = 7.15
4. 36.3 + 26.9 = 63.2
5. 7.9 + 4.6 = 12.5
6. 48.72 + 9.65 = 58.37
7. $9.79 + 2.81 = $12.60
8. $18.65 + 5.39 = $24.04
9. $90.33 + 44.83 = $135.16
10. 13.1 + 2.7 + 14.1 = 29.9
11. 5.3 + 26.8 + 3.2 = 35.3
12. 48.64 + 0.27 + 21.93 = 70.84
13. $ 5.92 + 13.93 + 0.76 = $20.61
14. $14.88 + 25.76 + 5.92 = $46.56
15. $98.76 + 54.32 + 10.98 = $164.06

Subtract.

16. 44.3 − 31.8 = 12.5
17. 19.67 − 6.83 = 12.84
18. 48.97 − 42.48 = 6.49
19. 93.0 − 75.3 = 17.7
20. 34.5 − 9.9 = 24.6
21. 13.16 − 9.64 = 3.52
22. 81.24 − 22.27 = 58.97
23. 35.1 − 26.5 = 8.6
24. 45.8 − 8.9 = 36.9
25. 50.1 − 11.8 = 38.3
26. 87.01 − 12.23 = 74.78
27. 90.0 − 37.5 = 52.5
28. $10.01 − 1.09 = $ 8.92
29. $40.11 − 39.47 = $ 0.64
30. $1.32 − 0.78 = $0.54
31. $63.02 − 16.54 = $46.48
32. $16.44 − 8.59 = $ 7.85
33. $25.40 − 15.78 = $ 9.62

Multiply.

1. 30 × 2 = 60
2. 60 × 3 = 180
3. 40 × 6 = 240
4. 60 × 5 = 300
5. 300 × 4 = 1200
6. 50 × 3 = 150
7. 700 × 2 = 1400
8. 80 × 7 = 560
9. 20 × 9 = 180
10. 50 × 4 = 200
11. 400 × 5 = 2000
12. 60 × 8 = 480

Divide.

13. 2)40 = 20
14. 4)800 = 200
15. 7)210 = 30
16. 3)120 = 40
17. 5)250 = 50
18. 3)210 = 70
19. 4)240 = 60
20. 7)490 = 70
21. 6)480 = 80
22. 9)540 = 60
23. 5)400 = 80
24. 8)400 = 50
25. 9)720 = 80
26. 9)630 = 70
27. 6)600 = 100
28. 8)720 = 90
29. 2)100 = 50
30. 7)420 = 60

Multiply.

31. 32 × 3 = 96
32. 423 × 2 = 846
33. 18 × 6 = 108
34. 375 × 7 = 2625
35. 541 × 5 = 2705
36. 703 × 8 = 5624
37. 486 × 4 = 1944
38. 426 × 9 = 3834
39. 588 × 8 = 4704
40. $436 × 6 = $2616
41. $1.84 × 7 = $12.88
42. $7.89 × 9 = $71.01

227

Page 227

OBJECTIVE

Demonstrate competence in addition, subtraction, multiplication, and division skills

RELATED ACTIVITIES

- Students may be asked to complete one or more of the following for extra practice and review:

1. use addition to check the answers for several subtraction exercises;
2. write the word name for each addend in a selection of addition exercises;
3. write the fraction numerals for the decimal numerals in a selection of subtraction exercises;
4. use play money or cutouts from pages T 351 and T 352 to represent amounts shown in a selection of addition and subtraction exercises (dollars, dimes, pennies);
5. use models for wholes, tenths, and hundredths to illustrate addition and subtraction of decimals;
6. use an abacus to illustrate sums and differences for decimals;
7. use models for tens and hundreds to illustrate extensions of basic multiplication and division facts.

SSON ACTIVITY

ing the Page

he exercises are grouped according to operation. The addition and subtraction exercises concern decimal tenths and decimal hundredths with regrouping. Ex. 1-30 in multiplication and division review extensions of basic facts with multiples of 10 or 100 as one factor.

Ex. 31-42 involve the use of the standard algorithm in multiplying a two-digit or a three-digit number by a one-digit number. For these exercises, some students may be more comfortable using the long form of multiplication rather than the standard algorithm. These students will have an opportunity to review the standard form in the first lesson of the next unit.

For the addition and subtraction exercises, emphasize accuracy and speed. For the extensions of multiplication and division facts, emphasize thinking of a basic fact. For example, for 2 × 700 (Ex. 7), emphasize thinking 2 × 7 hundreds = 14 hundreds or 1400, and for $7\overline{)210}$ (Ex. 15), emphasize thinking $\underset{\text{3 tens}}{7\overline{)21}}$ tens or 30.

Unit 10 Overview

Multiplication

This unit continues the work of using the standard algorithm for multiplication, which was started in Unit 5. The process is reviewed with one-digit multipliers and multiplicands having two and three digits. Rounding multiplicands to the nearest ten or to the nearest hundred is used in estimating products. Multiplication by multiples of ten is presented as a preliminary step before introducing multiplication by two-digit multipliers, which are interpreted in terms of tens and ones. Multiplicands at this stage have two or three digits, and some of the latter name dollars and cents. Word problems are provided at each stage throughout the unit to provide meaningful application of multiplication skills. A quick way of multiplying by 11 is hinted at in one of the lessons, as well as a quick method of checking multiplication. These are presented as interesting diversions and enrichment. The final lesson presents logical thinking as an important problem-solving skill.

Prerequisite Skills

- multiply a multiple of ten from 10 to 90 and a multiple of one hundred from 100 to 900 by a one-digit number
- interpret a standard numeral with zero in the ones' place as a number of tens
- interpret a two-digit numeral in terms of tens and ones

Unit Outcomes

- use the standard algorithm to multiply a two-digit number by a one-digit number; solve related word problems
- use the standard algorithm to multiply a three-digit number by a one-digit number; solve related word problems
- estimate a product by rounding the multiplicand to the nearest ten or the nearest hundred
- multiply a two-digit number by a multiple of ten from 10 to 90
- multiply a two-digit number by a two-digit number; solve related word problems
- multiply a three-digit number by a multiple of ten from 10 to 90
- multiply a three-digit number by a two-digit number
- solve a problem through a process of logical thinking

Background

For multiplication of numbers with two or more digits, there are several styles of algorithm with different levels and types of thinking. Some methods obtain partial products for each place value of the multiplicand and then add them (A). Others obtain fewer partial products by means of "carrying" from one place to the next (B). Still another method multiplies each place value of the multiplicand beginning from the left, rather than from the more conventional right, and is particularly useful in non-paper-and-pencil calculating (C). This last procedure may be seen more clearly by the format shown in D.

A

$$\begin{array}{r} 463 \\ \times\ \ 7 \\ \hline 21 \\ 420 \\ 2800 \\ \hline 3241 \end{array}$$

B

$$\begin{array}{r} {\scriptstyle 2\ 1} \\ 794 \\ \times\ \ \ 3 \\ \hline 2382 \end{array}$$

C

$$\begin{array}{r} 465 \\ \times\ \ 6 \\ \hline 2790 \end{array}$$

$2400 + 360 + 30$

D

$$\begin{aligned} 6 \times 465 &= 6 \times (400 + 60 + 5) \\ &= (6 \times 400) + (6 \times 60) + (6 \times 5) \\ &= 2400 + 360 + 30 \\ &= 2790 \end{aligned}$$

All of these aspects of multiplication are possible because the properties of multiplication, namely, the *commutat* (order), *associative* (grouping), and *distributive* propert These were discussed with respect to multiplication in Overview for Unit 5 on pages T 100 and T 101. Applicatio one or more of these properties can facilitate multiplying tw more factors. For example, the commutative property is u frequently in everyday life. The cost of 175 15-cent stamps, instance, can be found in fewer steps by interchanging the factors as shown in E.

E

$$\begin{array}{r} 15 \\ \times\ 175 \\ \hline 75 \\ 1050 \\ 1500 \\ \hline 2625 \end{array} \qquad \begin{array}{r} 175 \\ \times\ \ 15 \\ \hline 875 \\ 1750 \\ \hline 2625 \end{array}$$

The product for $4 \times 53 \times 25$ can be found most easily changing the order of the factors and grouping as in F, rat than multiplying in the given order as shown in G.

F

$$\begin{aligned} &(4 \times 25) \times 53 \\ &= 100 \times 53 \\ &= 5300 \end{aligned}$$

G

$$\begin{aligned} &(4 \times 53) \times 25 \\ &= 212 \times 25 \\ &= 5300 \end{aligned}$$

Similarly, for Ex. 23 on page 232, the product $4 \times 3 \times 7 \times 5$ can be found more easily by the arrangem and grouping shown in H, rather than the left-to-ri progression indicated in I.

H

$$\begin{aligned} &(4 \times 5) \times (3 \times 7) \\ &= 20 \times 21 \\ &= 420 \end{aligned}$$

I

$$\begin{aligned} &(4 \times 3) \times 7 \times \\ &= (12 \times 7) \times 5 \\ &= 84 \times 5 \\ &= 420 \end{aligned}$$

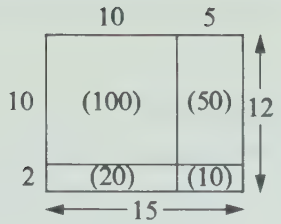
The associative property of multiplication helps to expl why several different sets of factors can have the same produ For example, 24 is the product for 4×6, 8×3, and $12 \times$ because each can be expressed as the product of the same pri factors in different arrangements.

$$\begin{aligned} 4 \times 6 &= (2 \times 2) \times (2 \times 3) \\ 8 \times 3 &= (2 \times 2 \times 2) \times 3 \\ 12 \times 2 &= (2 \times 2 \times 3) \times 2 \end{aligned}$$

The procedure shown in D above illustrates the distribut property of multiplication over addition. It is interesting to n how this property applies in multiplying two two-digit numbe for example, for 12×15, shown in two forms below. It also be seen how each partial product relates to one portion the area of a rectangle whose dimensions are 12 units by units.

$$\begin{aligned} &12 \times 15 \\ &= (10 + 2) \times (10 + 5) \\ &= (10 \times 10) + (10 \times 5) + (2 \times 10) + (2 \times 5) \\ &= 100 + 50 + 20 + 10 \\ &= 180 \end{aligned}$$

$$\begin{array}{r} 15 \\ \times\ 12 \\ \hline 10 \leftarrow 2 \times 5 \text{ ones} \\ 20 \leftarrow 2 \times 1 \text{ ten} \\ 50 \leftarrow 1 \text{ ten} \times 5 \\ 100 \leftarrow 1 \text{ ten} \times 1 \text{ ten} \\ \hline 180 \end{array}$$



should be pointed out that most of the above information is vided solely for the teacher. Items such as alternative hods of computing may be of interest to students. However, do not need to know the names of the properties and which s they are using in their work. Rather, they should be aware numbers and operations perform according to unchanging hematical rules.

n page 246, two interesting topics are presented. First, the ents are challenged to find a quick way of multiplying by 11. procedure involves adding pairs of digits of the other factor, n right to left. Consider the product for 11×435 in the owing steps:

435		
11	The ones' digit for $11 \times 43\boxed{5}$ is 5.	_ _ _ 5
435	The tens' digit for $11 \times 4\boxed{35}$ is 8.	_ _ 8 5
850	The hundreds' digit for $11 \times \boxed{43}5$ is 7.	_ 7 8 5
4785	The thousands' digit for $11 \times \boxed{4}35$ is 4.	4 7 8 5

sing the same procedure, $11 \times 3162 = 34\,782$, indicated 3 3 + 1 1 + 6 6 + 2 2.

right-to-left procedure is important because "carry" erals are sometimes involved. For example, for 11×75,

5		
1		
5	ones' digit	_ _ 5
0	tens' digit (from $7 + 5 = 12$)	_ 2 5
5	hundreds' digit (from $1 + 7$)	8 2 5

y does this method work? The explanation has to do with the that when 11 multiplies any number from 1 to 9, the product ays shows two identical digits, as in $11 \times 4 = 44$, and $\times 7 = 77$. Therefore, at each step in multiplying a number 11, each digit is used twice: first, to record the right-hand t and then, to add to the next place.

quick way of checking multiplication is the second topic of rest on page 246. The procedure, commonly known as sting out nines", involves adding the digits in the numbers l only one-digit numbers are obtained. The procedure for cking 17×68 is shown here.

68 → 6 + 8 = 14 → 1 + 4 = 5
17 → 1 + 7 = 8
76
80
56 → 1 + 1 + 5 + 6 = 13 → 1 + 3 = 4

$$\begin{array}{r} 5 \\ \times\ 8 \\ \hline 40 \rightarrow 4 + 0 = 4 \end{array}$$

aching Strategies

uccessful progress in this unit can be seriously impeded if dents do not know the basic multiplication facts. It is most ortant, therefore, that a thorough assessment be taken at the inning of the unit and that, according to need, appropriate ctice be organized in the form of drill devices and games. It is ngly recommended that basic facts with unlike factors be practiced in pairs, such as $9 \times 4 = 36$ and $4 \times 9 = 36$, so that either or both of the facts are learned quickly and efficiently.

Students need a clear understanding of place-value concepts to avoid incorrect procedures such as those indicated below. Emphasizing that there are two steps in the multiplication (multiplying the ones, multiplying the tens) is helpful, and more so if the procedure is related to models of tens and ones. Also, some students make the error of adding the "carried" number before multiplying, as in $2 \times 26 = 62$ as opposed to $2 \times 26 = 52$. Oral drills in the form of $(2 \times 2) + 1$ would help to emphasize the correct order of the steps for related exercises.

common errors

26	26	26
× 2	× 2	× 2
412	12	12
	4	40
	16	52

In introducing the product of two two-digit numbers, the students first encounter multiples of ten as multipliers. Place-value is most important in this work. Students need to know, for example, that 27 tens names the same number as 270, and that 234 tens names the same number as 2340. Exercises similar to the following can emphasize the idea that when one of the factors is a multiple of ten, the product is also a multiple of ten.

$1 \times 27 = 27$ $1 \text{ ten} \times 27 = 27 \text{ tens}$ $10 \times 27 = 270$	$2 \times 27 = 54$ $2 \text{ tens} \times 27 = 54 \text{ tens}$ $20 \times 27 = 540$
$3 \times 27 = 81$ $3 \text{ tens} \times 27 = 81 \text{ tens}$ $30 \times 27 = 810$	$4 \times 27 = 108$ $4 \text{ tens} \times 27 = 108 \text{ tens}$ $40 \times 27 = 1080$

Eventually, for exercises in vertical form, students can write a 0 in the ones' place to show that the product is a number of tens, and then multiply by the number in the tens' place. This procedure extends naturally to multiplying by two-digit numbers that are not multiples of ten.

$$\begin{array}{r} 39 \\ \times\ 60 \\ \hline 2340 \end{array}$$

$$\begin{array}{r} 27 \\ \times\ 34 \\ \hline 108 \leftarrow 4 \times 27 \\ 810 \leftarrow 3 \text{ tens} \times 27 \\ \hline 918 \end{array}$$

$$\begin{array}{r} 39 \\ \times\ 62 \\ \hline 78 \leftarrow 2 \times 39 \\ 2340 \leftarrow 6 \text{ tens} \times 39 \\ \hline 2418 \end{array}$$

During the early stages with one-digit multipliers, students will probably show the "carried" digits above the multiplicands, but when they reach multipliers with two digits, they will have two sets of such numerals. It would be advisable to encourage the students to try to complete their work, as far as possible, without showing the "carried" digits.

Results of the check-up at the end of the unit should be examined carefully to detect any particular areas of weakness. The chart on page T 267 may be used to pinpoint the precise skills and the lessons in the text where they are developed. According to common needs, students should be grouped for reteaching and further practice while others carry out some of the related activities suggested in the lesson outlines.

Pages 228-229

LESSON OUTCOME

Use the standard algorithm to multiply a two-digit number by a one-digit number; solve related word problems

Prerequisite Skills

Multiply a multiple of ten from 10 to 90 by a one-digit number

Checking Prerequisite Skills

Multiply.

1. 20 × 4 = 80	**2.** 80 × 3 = 240	**3.** 70 × 9 = 630
4. 60 × 7 = 420	**5.** 40 × 5 = 200	**6.** 90 × 8 = 720

10 MULTIPLICATION

Multiplying Two-Digit Numbers

3 Roadcruisers cross Newfoundland from St. John's to Port aux Basques each day. Each can carry 47 passengers. How many can they carry in all?

Multiply 3 and 47.

47×3

$3 \times 7 = 21$, or 2 tens 1 one.

3×4 tens $= 12$ tens, and 2 more tens are 14 tens.

This is the standard form for multiplying.

The standard form lets me write the product on the first line below the two factors.

Add.

The Roadcruisers can carry 141 passengers.

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LESSON ACTIVITY

Before Using the Pages

- Write a few multiplication exercises on the board and review the long form for multiplying a two-digit number by a one-digit number.

53 × 8 = 24 + 400 = 424	25 × 6 = 30 + 120 = 150	79 × 3 = 27 + 210 = 237

Have students interpret each exercise in terms of equal groups, for example, 8 groups of 53 for 8×53. In the two multiplication steps they should think of 8 groups of 3 and 8 groups of 5 tens.

Using the Pages

- Read the word problem with the students and discuss that the solution can be found by using multiplication, since the problem involves a number of equal groups. Have t students contrast the long form for multiplying 3 and with the standard form. Note, for example, where the 2 2 tens is written in the standard form. Explain that t addition of 2 tens is carried out after finding the product 4 tens and 3. Have students suggest an advantage of usi the standard form, as noted in the "thought cloud". Y may also wish to point out that knowing the standard fo will help in completing multiplications, such as 92×22 later in this unit. Finally, draw attention to the concludi statement at the bottom of page 228.

Working Together: Have the students study the example th precedes Ex. 1. Then have one or two students explain t standard form in their own words. Remind the students th although we think of the basic fact $7 \times 8 = 56$, we a really working with tens as in 7×8 tens $= 56$ te Emphasize that the addition of the regrouped number performed after the multiplication, not before.

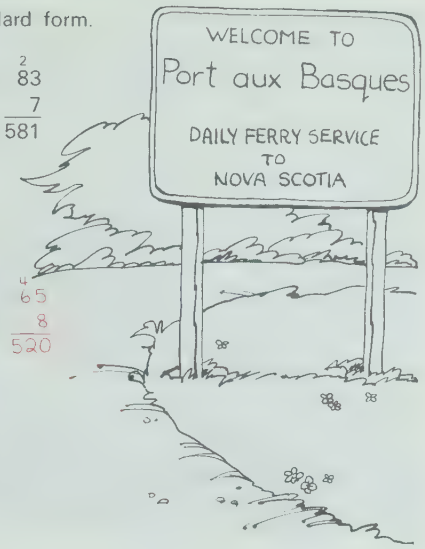
The products obtained by using the standard form for E 1-3 may be checked with those given for the long for

Working Together

Show each multiplication in the standard form.

Example: 83×7 becomes $\overset{2}{8}3 \times 7$

$$\begin{array}{r} 7 \\ 21 \\ 560 \\ \hline 581 \end{array} \quad \begin{array}{l} 7 \times 3 \\ 7 \times 80 \end{array} \qquad \begin{array}{r} \overset{2}{8}3 \\ 7 \\ \hline 581 \end{array}$$



1. 32×3 32 / 3 / 96 **2.** 73×9 $\overset{2}{7}3$ / 9 / 657 **3.** 65×8 $\overset{4}{6}5$ / 8 / 520

Multiply. Use the standard form.

4. 24×2 48 **5.** 87×3 261 **6.** 48×7 336

Exercises

Multiply. Use the standard form.

1. 16×4 64	**2.** 21×8 168	**3.** 94×5 470	**4.** 54×6 324	**5.** 96×2 192	**6.** 56×7 392	**7.** 35×5 175
8. 22×9 198	**9.** 93×4 372	**10.** 99×3 297	**11.** 47×8 376	**12.** 39×7 273	**13.** 30×8 240	**14.** 31×4 124
15. 87×2 174	**16.** 62×5 310	**17.** 64×7 448	**18.** 26×3 78	**19.** 90×9 810	**20.** 95×7 665	**21.** 64×9 576

22. 9×31 279 **23.** 5×47 235 **24.** 6×33 198 **25.** 6×71 426 **26.** 8×78 624

27. 2×49 98 **28.** 7×72 504 **29.** 6×27 162 **30.** 3×35 105 **31.** 6×48 288

Solve.

32. Mr. Brock travels 37 km on the bus each day. How far does he travel on the bus in 5 working days? 185 km

33. Adult fare for the Roadcruiser across Newfoundland is about $23. About how much would 4 adults have to pay? $92

Have students show solutions on the board for Ex. 4-6 and discuss any difficulties that arise.

ercises: For Ex. 22-31, remind the students to write the multiplications in vertical form.

sessment

ltiply. Use the short form.

1. 61 / 8 / 488 **2.** 17 / 3 / 51 **3.** 34 / 6 / 204 **4.** 59 / 7 / 413

lve.

Andy travels 26 km on the bus each day. How far does he travel in 5 days? 130 km

RELATED ACTIVITIES

- Students who are unsure of basic multiplication facts will need opportunities to review and practice the necessary facts. Copies of the table on page T 350 can be useful for an organized review. For example, they may color inside the squares for facts as they are memorized.
- Some students may need to practice extensions of basic addition facts since these are applied in the standard form for multiplication. For example, to complete the multiplication given below, the required addition is $56 + 5 = 61$ (an extension of the basic fact $6 + 5 = 11$).

$$\begin{array}{r} \overset{5}{} \\ 88 \\ \times \quad 7 \\ \hline \quad 6 \end{array}$$

Have students complete patterns in addition similar to the following.

$$6 + 5 \qquad 16 + 5 \qquad 26 + 5 \qquad \ldots \qquad 86 + 5$$

- Students having difficulty with the standard algorithm may find it helpful to complete exercises similar to the following.

24×3	65×7	67×5
72	455	335

Pages 230-231

LESSON OUTCOME

Use the standard algorithm to multiply a three-digit number by a one-digit number; solve related word problems

Prerequisite Skills

Multiply multiples of one hundred from 100 to 900 by a one-digit number

Checking Prerequisite Skills

Multiply.

1. 200	2. 400	3. 600
3	7	9
600	2800	5400

Multiplying Three-Digit Numbers

The ferry between Newfoundland and Nova Scotia carries about 345 vehicles each sailing. About how many vehicles will it carry in 4 sailings?

Multiply 4 and 345.

$$\begin{array}{r} {\scriptstyle 2} \\ 345 \\ \times\ 4 \\ \hline 0 \end{array}$$

4 × 5 = 20 or 2 tens 0 ones.

$$\begin{array}{r} {\scriptstyle 1\ 2} \\ 345 \\ \times\ 4 \\ \hline 80 \end{array}$$

4 × 4 tens = 16 tens. 2 more tens make 18 tens or 1 hundred 8 tens.

$$\begin{array}{r} {\scriptstyle 1\ 2} \\ 345 \\ \times\ 4 \\ \hline 1380 \end{array}$$

4 × 3 hundreds = 12 hundreds. 1 more hundred makes 13 hundreds.

The ferry carries about 1380 vehicles in 4 sailings.

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LESSON ACTIVITY

Before Using the Pages

- Review the steps of the standard algorithm for multiplication by using the following exercise on the board.

$$\begin{array}{r} {\scriptstyle 2} \\ 45 \\ \times\ 4 \\ \hline 180 \end{array}$$

Using the Pages

- Discuss that the boat in the photograph on page 230 is a ferry boat. Students who have been on a ferry boat at any time may tell about their experiences and describe different kinds of ferry boats. (Contrast the boats in the two photographs on these pages.)
- Read the problem and discuss why multiplication can be used to solve it. Have the students compare the multiplication with the one completed in *Before Using the Pages* and t how they are alike and how they are different.

$$\begin{array}{r} 45 \\ \times\ 4 \\ \hline \end{array} \qquad \begin{array}{r} 345 \\ \times\ 4 \\ \hline \end{array}$$

Have students describe the steps of the multiplication the worked example. The red on the numerals helps them focus on the important aspects at each stage of t multiplication.

Emphasize that the procedure for multiplying a thre digit number by a one-digit number using the standa algorithm is the same as for multiplying a two-dig number. The procedure is simply carried out for one mo place, the hundreds' place. Have a student read t concluding statement.

Exercises: It may be necessary to give special attention to Ex. F, L, and O in which zero occurs in the tens' place of t multiplicand. Students should be reminded that the produ is zero, and the number of tens from the ones' product written in the tens' place.

RELATED ACTIVITIES

- The second activity described in *Related Activities* on page T 53 may be adapted for multiplication.

hundreds	tens	ones
1 2 ×	1 8	7 2
5	7	4

Exercises

Multiply.

1. 377 × 3 = 1131	**2.** 371 × 2 = 742	**3.** 989 × 2 = 1978	**4.** 284 × 5 = 1420	**5.** 969 × 6 = 5814	**6.** 721 × 8 = 5768
7. 623 × 9 = 5607	**8.** 743 × 4 = 2972	**9.** 502 × 6 = 3012	**10.** 970 × 8 = 7760	**11.** 513 × 5 = 2565	**12.** 900 × 7 = 6300

Multiply. The products can help you find the answer to the riddle.

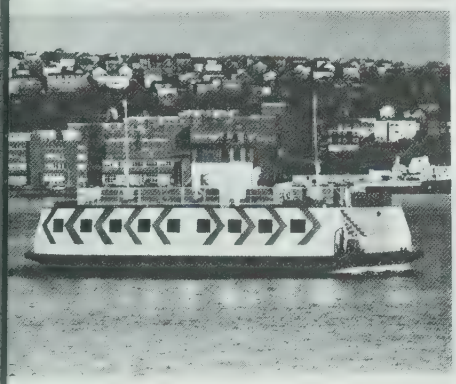
A 175 × 4 = 700	C 315 × 8 = 2520	E 472 × 9 = 4248	F 803 × 6 = 4818
H 530 × 4 = 2120	I 432 × 5 = 2160	K 298 × 2 = 596	L 206 × 3 = 618
O 104 × 9 = 936	R 767 × 8 = 6136	T 543 × 6 = 3258	Y 618 × 7 = 4326

Riddle:

The trail a boat leaves in the water is called its *wake*. What could you call the wake of a ferry boat?

Answer:

F	E	R	R	Y
4818	4248	6136	6136	4326
3258	6136	700	2160	618
T	R	A	I	L



Smaller ferries are used for shorter crossings.

13. Each day Mr. Sims uses a ferry 4 times. Each trip takes 13 min. How much time does it take for 4 trips? 52 min

14. How many hours does a ferry operate in a week when it operates for 14 h each day? 98

15. How much does it cost for 7 crossings if one costs 35¢? $2.45

16. One ferry travels about 375 m each crossing. About how far does it travel in 8 crossings? 3000 m

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The word problems involve units of measure for time (Ex. 13 and 14), money (Ex. 15), and length (Ex. 16). You may wish to have the students show their answers two ways for Ex. 15 (245¢ or $2.45) and Ex. 16 (3000 m or 3 km).

sessment

ltiply.

209 × 6 = 254	**2.** 143 × 5 = 715	**3.** 297 × 2 = 594	**4.** 486 × 7 = 3402

ve.

The ferry makes 4 trips each day. How many trips does it make in 365 days? 1460

Pages 232-233

OBJECTIVE

Demonstrate competence in multiplying a three-digit number by a one-digit number using the standard form; solve related word problems

Practice

Multiply.

1. 5 × 160 800 **2.** 4 × 412 1648 **3.** 6 × 101 606 **4.** 3 × 611 1833 **5.** 9 × 418 3762
6. 3 × 122 366 **7.** 8 × 610 4880 **8.** 2 × 404 808 **9.** 5 × 332 1660 **10.** 7 × 777 5439

11. 487 × 6 = 2922 **12.** 169 × 7 = 1183 **13.** 493 × 3 = 1479 **14.** 279 × 4 = 1116 **15.** 141 × 9 = 1269 **16.** 435 × 7 = 3045
17. 391 × 9 = 3519 **18.** 210 × 7 = 1470 **19.** 326 × 4 = 1304 **20.** 555 × 9 = 4995 **21.** 246 × 8 = 1968 **22.** 601 × 4 = 2404

23. 4 × 3 × 7 × 5 420 **24.** 5 × 9 × 3 × 2 270 **25.** 8 × 7 × 0 × 9 0
26. 3 × 3 × 3 × 3 81 **27.** 8 × 8 × 8 × 8 4096 **28.** 9 × 7 × 1 × 4 252

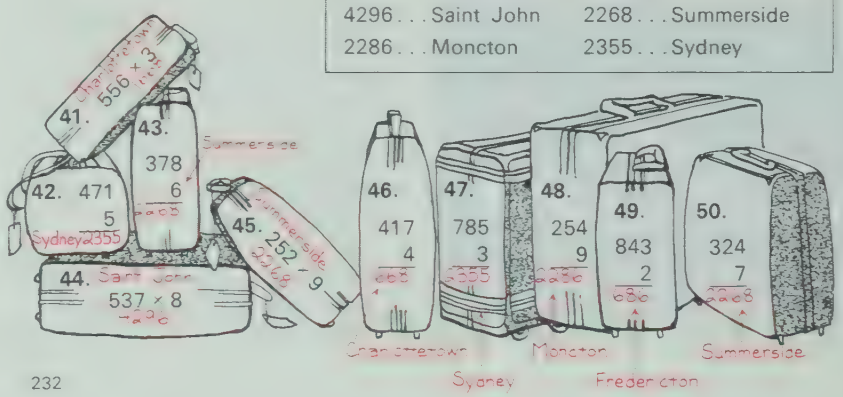
Many of these products are not correct. Copy the exercises and ring the errors you find. Then multiply correctly.

29. 312 × 3 = 936 **30.** 646 × 3 = 1928 1938 **31.** 736 × 5 = 3580 3680 **32.** 812 × 8 = 6490 6496 **33.** 407 × 6 = 2442 **34.** 47 × 9 = 3663 423

35. 234 × 8 = 1642 1872 **36.** 182 × 8 = 1456 **37.** 817 × 4 = 3268 **38.** 582 × 9 = 4738 5238 **39.** 325 × 6 = 1850 1950 **40.** 901 × 7 = 637 6307

Where would you send each suitcase?

1686 . . . Fredericton	1668 . . . Charlottetown
4296 . . . Saint John	2268 . . . Summerside
2286 . . . Moncton	2355 . . . Sydney



LESSON ACTIVITY

Using the Pages

- Ex. 1-22 provide practice in multiplication using the standard form. This skill is applied in Ex. 23-28 in finding products with four factors. If necessary, review the procedure with the students or refer them to pages 120 and 121 to review the procedure on their own.

  Ex. 29-40 involve finding and correcting errors in multiplication exercises. Similar exercises have been encountered earlier for addition and subtraction. You may wish to draw the students' attention to the example at the top of page 41, to review the manner of ringing a column that has an error. For the exercises that have no errors, the students may write "correct".

  29. 312 × 3 = 936 correct

  For Ex. 41-50, ensure that the students understand th the product obtained determines the city to which a suitca will be sent.

  Several problem-solving skills are involved in E 51-58, such as finding the necessary information not give in the problem (Ex. 51, 52, 54, 58), choosing th information needed (Ex. 55-57), and using two or mo steps to solve the problem (Ex. 54 and 58).

Adult airfare from Halifax to Fredericton is $39.

51. How much would it cost for 4 adult fares from Halifax to Fredericton? $156

52. How much would it cost for 8 adult fares from Halifax to Fredericton? $312

53. A child's fare from Halifax to Fredericton is $26. How much would tickets cost for 4 children? $104

***54.** The Gilbert family traveled from Halifax to Fredericton. How much were their 2 adult and 3 children's fares? $156

55. If Flight 667 carries about 225 passengers each week, about how many does it carry in 4 weeks? 900

56. If Flight 662 carries about 35 passengers each day, about how many does it carry in a week? 245

57. Airfares from Fredericton to Montreal are $56 for adults and $37 for children. How much would 3 adult fares be? $168

***58.** How much would tickets from Fredericton to Montreal cost the Gilbert family? $223

RELATED ACTIVITIES

- Ex. 25 provides an opportunity to review zero as a factor. Have students explain why it is unnecessary to carry out the multiplication. Provide other similar exercises (see *Related Activities* on page T 129).
- Ex. 23-25 and 28 may be completed in more than one way because the *associative property* and the *commutative property* of multiplication make it possible to rearrange and group three or more factors without altering their product; for example, each of the following has the product 24.

$$2 \times 3 \times 4$$
$$2 \times 4 \times 3$$
$$4 \times 2 \times 3$$
$$4 \times 3 \times 2$$
$$3 \times 4 \times 2$$
$$3 \times 2 \times 4$$

- Have students show two ways of solving Ex. 52, one way using the numbers 8 and 39, and another way using their answer for Ex. 51.
- Emphasize the advantage in knowing how to multiply by having students show the additions needed to complete some of these exercises. For Ex. 11, for example, the addition would be

$$\begin{array}{r} 487 \\ 487 \\ 487 \\ 487 \\ 487 \\ \underline{487} \end{array}$$

Pages 234-235

LESSON OUTCOME

Estimate a product by rounding the multiplicand to the nearest ten or the nearest hundred

Prerequisite Skills

Multiply a multiple of ten from 10 to 90 and a multiple of one hundred from 100 to 900 by a one-digit number

Checking Prerequisite Skills

Multiply.

1. 20 × 6 = 120

2. 70 × 4 = 280

3. 500 × 3 = 1500

4. 900 × 8 = 7200

Estimating Products

Guy's mother spends 28 min on the Metro each day. About how many minutes does she spend on the Metro in 5 working days?

To estimate the number of minutes that Guy's mother spends on the Metro, round 28 to the nearest ten.

28 rounds to 30.

Multiply 5 and 30.

$$\begin{array}{r} 30 \\ \times\ 5 \\ \hline 150 \end{array}$$

How many hours is 150 min?

Guy's mother spends 150 min on the Metro in 5 working days.

234

LESSON ACTIVITY

Using the Pages

- Have students identify the means of transportation suggested in the photograph on page 234. Students who have traveled on a subway system may tell other students about their experiences.
- Have a student read the word problem. Draw attention to the word "About" at the beginning of the second sentence and discuss its meaning in relation to the title, *Estimating Products*, at the top of the page. Emphasize that since an exact answer is not required, an estimate can be obtained by rounding 28 to the nearest ten. If necessary, review that 28 is between 20 and 30 but is closer to 30, and thus is rounded up to 30. Most students will likely agree that the multiplication 5×30 can be carried out more easily than 5×28. Have students find the number of hours in 150 min and explain their procedure.

Working Together: Ex. 1-6 examine the students' skill rounding two-digit numbers to the nearest ten (Ex. 1-3) a three-digit numbers to the nearest hundred (Ex. 4-6). U other similar exercises as needed, referring to a numb line, if necessary, to help students recall the procedure rounding numbers. Pay particular attention to Ex. 3 and to review that numbers such as these are rounded up, n down.

Ex. 7-12 apply the skill of rounding to estimate produc Ensure that the students show each exercise with t multiplicand in rounded form.

Exercises: Ensure that the students understand whether to rou to the nearest ten or to the nearest hundred to estimate t product. (Note that in Ex. 12, 99 rounded to the nearest t is 100.)

If necessary, explain what is meant by "turnstile" in t statement preceding Ex. 13. Ex. 15 will likely challen many students. Some may use an answer obtain

Working Together

Round to the nearest ten.

1. 17 20 **2.** 51 50 **3.** 85 90

Round to the nearest hundred.

4. 309 300 **5.** 281 300 **6.** 450 500

Round to the nearest ten and multiply.

7. 86 × 5 = 450 **8.** 33 × 7 = 210 **9.** 4 × 28 = 120

Round to the nearest hundred and multiply

10. 328 × 4 = 1200 **11.** 596 × 2 = 1200 **12.** 5 × 187 = 1000

Exercises

Round the two-digit factors to the nearest ten. Round the three-digit factors to the nearest hundred. Then multiply to estimate each product.

1. 91 × 4 = 360 **2.** 467 × 2 = 1000 **3.** 112 × 9 = 900

4. 159 × 3 = 600 **5.** 32 × 8 = 240 **6.** 215 × 4 = 800

7. 49 × 2 = 100 **8.** 276 × 5 = 1500 **9.** 43 × 7 = 280

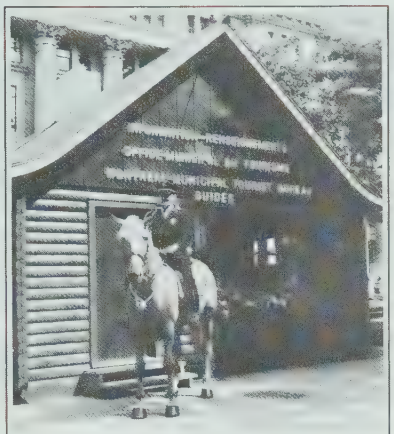
10. 750 × 6 = 4800 **11.** 806 × 5 = 4000 **12.** 99 × 3 = 300

A count showed 425 people passed through one turnstile in one hour. Use this number to estimate

13. how many pass through 5 turnstiles in 1 h. about 2000

14. how many pass through 1 turnstile in 8 h. about 3200

***15.** how many pass through 5 turnstiles in 8 h. about 16 000



If the Tourist Bureau has about 385 visitors each day and gives each visitor a map and 2 guide folders, Answers may vary.

1. estimate the number of maps and folders needed for 6 d. about 2400 maps and 4800 guide folders

2. If maps come in bundles with 575 in each bundle, estimate whether there are enough maps in 4 bundles to last for 6 d. no

PROBLEM SOLVING

RELATED ACTIVITIES

- Have students round two-digit factors and three-digit factors and estimate the products for:
  Ex. 1-31 on page 229;
  Ex. 1-12 and A-Y on page 231;
  Ex. 1-22 on page 232.

They may be able to perform the computations mentally and write only the products.

previously to help solve the problem. Others may start the solution by finding 5×8 and then be faced with the multiplication 40×400. Provide ample time for the students to explore this problem and encourage them to find different ways of solving it. The solutions may be shared and discussed. Some possible solutions are shown below.

400 × 5 = 2000	2000 × 8 = 16 000
400 × 8 = 3200	3200 × 5 = 16 000

8 × 5 = 40	400 × 40 = ?	400 + 400 + ⋮ + 400 = 16 000

Problem Solving: These exercises involve multiplication with estimation. Showing the information in a chart may help students to solve the problems. Remind them to round 385 to the nearest hundred first.

	1 day	6 days
Maps	400	?
Guide folders	800	?

For Ex. 2, an estimate of the answer indicates that there are likely enough maps to last for 6 days. However, suggest to the students that they find the exact number of maps available ($4 \times 575 = 2300$) and the exact number of maps required ($6 \times 385 = 2310$). This will help to emphasize that an estimate is close to the exact answer but may be greater than (or less than) the exact answer. The exact answer indicates that 4 bundles are not enough.

Assessment

Round the two-digit factors to the nearest ten and multiply.

1. 19 20 × 2 2 = 40 **2.** 81 80 × 7 7 = 560

Round the three-digit factors to the nearest hundred and multiply.

3. 624 600 × 5 5 = 3000 **4.** 385 400 × 8 8 = 3200

Pages 236-237

LESSON OUTCOME

Multiply a two-digit number by a multiple of ten from 10 to 90

Prerequisite Skills

Multiply a two-digit number by a one-digit number; interpret a standard numeral with zero in the ones' place as a number of tens

Checking Prerequisite Skills

Multiply.

1. 29 × 4 = 116

2. 17 × 7 = 119

3. 75 × 6 = 450

Complete.

4. 90 = 9 tens

5. 40 = 4 tens

6. 70 = 7 tens

Multiplying Two-Digit Numbers by Multiples of Ten

The tour boat on the St. Lawrence River sells about 75 of these post cards each day. About how many post cards will be sold in 30 d?

Multiply 30 and 75.

For the product $\begin{array}{r} 75 \\ \times\ 30 \\ \hline \end{array}$ (3 tens 0 ones)

you need to know how to multiply 0 and 75

$$\begin{array}{r} 75 \\ \times\ 30 \\ \hline 0 \end{array}$$

When 0 is a factor, the product is 0.

and how to multiply 3 and 75.

$$\begin{array}{r} 75 \\ \times\ 30 \\ \hline 2250 \end{array}$$

3 tens × 75 = 225 tens or 2250.

About 2250 post cards will be sold in 30 d.

236

LESSON ACTIVITY

Before Using the Pages

- Have students suggest ways of multiplying a two-digit number by a multiple of ten. Write exercises such as 10 × 24 on the board and have students show their methods for finding the products. Some may relate the multiplication to repeated addition and show the sum of ten 24's as 240. Others may think of 10 × 24 as 1 ten × 24 to obtain 24 tens. Whatever method is used, the results may be summarized as shown below to facilitate understanding and to enable students to see similarities in multiplying by 1 and multiplying by 10.

24	24	24
× 1	× 1 ten	× 10
24	24 tens	240

82	82	82
× 1	× 1 ten	× 10
82	82 tens	820

Draw attention to the 0 in the one's place of the produ when one factor is 10.

Using the Pages

- In a brief discussion of the photograph, have students expla the difference between a tour boat and a ferry boat. Sor students may be able to tell about tours they have taken o boat.

- Discuss what is meant by "multiples of ten" in the title a show the numerals 10, 20, 30, 40, . . ., 90 on the boa Review that 10 was used as a factor in *Before Using t Pages*.

  Read the word problem and discuss why multiplicati can be used to find the answer. Ask which factor is multiple of ten.

  Suggest that since 30 is the same as 3 tens 0 ones, t multiplication can be thought of in two parts. Multiplying and 75 helps to show why there are 0 ones in the produc This is reinforced by thinking of 3 tens × 75 as 225 ten which is 2250. Both explanations for the 0 are important.

Working Together

Use the first statement to help you complete the other multiplication statements.

1. $7 \times 21 = 147$
   $7 \text{ tens} \times 21 = \square \text{ tens } 147$
   $70 \times 21 = 1470$

2. $2 \times 38 = 76$
   $2 \text{ tens} \times 38 = \text{tens } 76$
   $20 \times 38 = \square\ 760$

3. 49 49 49
   6 6 tens 60
   294 tens
   294 2940

Write 0 in the ones place. Then multiply by 3 (tens).

4. 21 → 30 → 630
5. 72 → 30 → 2160
6. 68 → 30 → 2040

Multiply.

7. 32 → 60 → 1920
8. 23 → 10 → 230
9. 78 → 40 → 3120

Exercises

Multiply.

1. 14 → 20 → 280	2. 23 → 80 → 1840	3. 17 → 70 → 1190	4. 29 → 40 → 1160	5. 34 → 10 → 340	6. 44 → 50 → 2200	7. 89 → 30 → 2670
8. 62 → 40 → 2480	9. 36 → 90 → 3240	10. 56 → 30 → 1680	11. 45 → 80 → 3600	12. 36 → 40 → 1440	13. 52 → 80 → 4160	14. 54 → 70 → 3780
15. 37 → 50 → 1850	16. 83 → 60 → 4980	17. 57 → 20 → 1140	18. 94 → 90 → 8460	19. 76 → 20 → 1520	20. 66 → 60 → 3960	21. 85 → 90 → 7650
22. 85 → 40 → 3400	23. 39 → 70 → 2730	24. 63 → 20 → 1260	25. 37 → 30 → 1110	26. 75 → 60 → 4500	27. 56 → 50 → 2800	28. 34 → 80 → 2720

Add.

1. 48 + 120 = 168	2. 23 + 1840 = 1863	3. 256 + 640 = 896	4. 31 + 930 = 961	5. 704 + 7920 = 8624	6. 243 + 270 = 513
7. 86 + 860 = 946	8. 532 + 4560 = 5092	9. 96 + 1920 = 2016	10. 248 + 930 = 1178	11. 336 + 2880 = 3216	12. 68 + 340 = 408
13. 168 + 960 = 1128	14. 664 + 2490 = 3154	15. 273 + 390 = 663	16. 295 + 4720 = 5015	17. 288 + 720 = 1008	

KEEPING SHARP

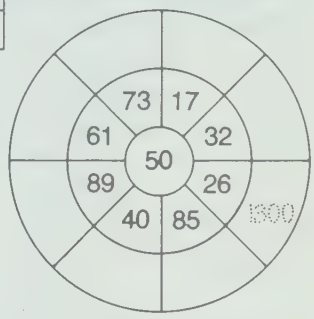
237

RELATED ACTIVITIES

- Students may complete tables and number wheels similar to the following (use copies of page T360).

×	4	8	12	16
20				

×	14
10	
20	
30	



- A work sheet similar to the following may help some students.

Use the product in one exercise to help find the product in the other exercise.

1. $2 \times 16 = 32$
   $20 \times 16 = \_\_\_\_$
2. $5 \times 41 = 205$
   $50 \times 41 = \_\_\_\_$
3. $3 \times 29 = \_\_\_\_$
   $30 \times 29 = 870$
4. $8 \times 34 = \_\_\_\_$
   $80 \times 34 = 2720$

the following lesson on pages 238 and 239 there may not be 0 ones in the final product since the multiplier can be any two-digit number.

It would be helpful to review on the board the exercises that were developed in *Before Using the Pages*, to point out the two steps suggested by the worked example. For 10×24, for example,

multiply 0 and 24,

2	4
1	0
	0

multiply 1 (ten) and 24.

	2	4
	1	0
2	4	0

king Together: Ex. 1-3 help students to relate multiplying by a multiple of ten to multiplying by a one-digit number. For each exercise, point out the similarity between the first product and the last product to emphasize that the only difference is the 0 in the ones' place. Since this occurs each time, Ex. 4-6 suggest that the 0 ones may be written in the ones' place and the multiplication by the number of tens may continue, as if by a one-digit number. Use other similar exercises as required. Have students explain their work on the board for Ex. 7-9.

Exercises: Observe the students as they work in order to provide assistance and reinforcement as needed.

Keeping Sharp: These exercises prepare the students for the kinds of addition they will encounter in multiplying two two-digit numbers in the following lesson. For example, Ex. 11 is related to the following multiplication.

$$\begin{array}{r} 48 \\ \times\ 67 \\ \hline 336 \\ 2880 \\ \hline 3216 \end{array}$$

Remind the students to take care in copying the addends so that the places are lined up correctly.

Assessment

Multiply.

1. 14 → 30 → 420	2. 51 → 70 → 3570	3. 29 → 60 → 1740	4. 73 → 80 → 5840

Pages 238-239

LESSON OUTCOME

Multiply a two-digit number by a two-digit number

Prerequisite Skills

Multiply a two-digit number by a one-digit number; interpret a two-digit numeral in terms of tens and ones

Checking Prerequisite Skills

Multiply.

1. 22 × 2 = 44

2. 22 × 5 = 110

3. 34 × 6 = 204

4. 34 × 9 = 306

Complete.

5. 64 = 6 tens 4 ones

6. 37 = 3 tens 7 ones

7. 49 = 4 tens 9 ones

8. 94 = 9 tens 4 ones

Multiplying Two-Digit Numbers by Two-Digit Numbers

An elevator in the CN Tower in Toronto can carry 22 passengers each trip. On busy days, it can make 20 to 30 trips each hour. How many passengers can the elevator carry in 25 trips?

Multiply 25 and 22.

For the product

$$\begin{array}{r} 22 \\ \times\ 25 \end{array}$$ 2 tens 5 ones

you need to know how to multiply 5 and 22

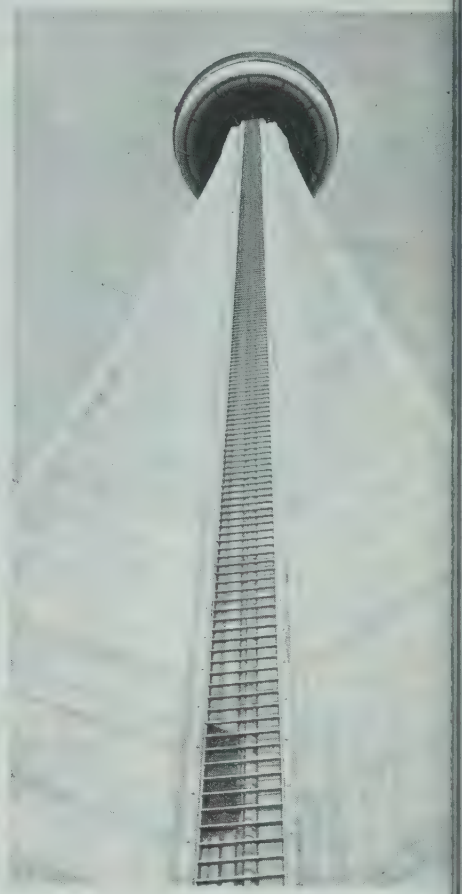
$$\begin{array}{r} {\scriptstyle 1} \\ 22 \\ \times\ 25 \\ \hline 110 \end{array}$$

and how to multiply 2 and 22.

$$\begin{array}{r} {\scriptstyle 1} \\ 22 \\ \times\ 25 \\ \hline 110 \\ 440 \end{array}$$ 2 tens × 22 = 44 tens or 440.

Then add.

$$\begin{array}{r} {\scriptstyle 1} \\ 22 \\ \times\ 25 \\ \hline 110 \\ 440 \\ \hline 550 \end{array}$$



The elevator can carry 550 passengers in 25 trips.

238

LESSON ACTIVITY

Before Using the Pages

- Briefly review the work of the previous lesson. On the board, write a few exercises similar to those shown below. Have students explain their solutions as they write them on the board. Suggest that knowing how to multiply by a multiple of ten will be helpful in multiplying any two-digit numbers. Emphasize the 0 in the ones' place of the product.

18	34	69
× 20	× 50	× 80
360		

Using the Pages

- Have students identify the structure in the photograph and suggest what means is used to transport people to and from the viewing platform of the tower. Read the word problem and discuss that the solution can be found by using multiplication since there are 25 groups of 22. Discuss that it would be time consuming to use addition, although it is certainly one way of finding the answer. Multiplication more efficient way of finding the answer.

The worked example demonstrates that the product be found by carrying out two multiplications as in preceding lesson. The difference is that there are different products on two lines. Thus, an addition ste needed to combine the two products. Have students exp the multiplication of 5 and 22 and of 2 tens and 22. The on the numerals helps the students to focus on each ste the procedure. Ask why addition is required to find product.

Working Together: Exercises such as Ex. 1 and 2 lead students through the steps of the procedure in multiply by a two-digit number. They also emphasize that procedure is similar to multiplying by a one-digit num twice. Emphasize that 0 is needed in the ones' place w multiplying by a number of tens. Use other sim exercises and describe the steps that are to be taken. W you feel that the students are ready, assign Ex. 3-6 and discussing them, have the steps of the procedure explain

Working Together

Multiply by following the steps.

1.

14
32

Multiply 2 and 14. → 28
Write 0 in the ones place. → 420
Then multiply 3 and 14. → 448
Add.

3 tens × 14 = 42 tens.

2.

87
54

Multiply 4 and 87. → 348
Write 0 in the ones place. → 4350
Then multiply 5 and 87. → 4698
Add.

5 tens × 87 = tens.

Multiply.

3. 23 × 31 = 713 **4.** 72 × 26 = 1872 **5.** 43 × 52 = 2236 **6.** 96 × 48 = 4608

Exercises

Multiply.

1. 14 × 12 = 168	**2.** 22 × 34 = 748	**3.** 36 × 22 = 792	**4.** 47 × 17 = 799	**5.** 80 × 19 = 1520	**6.** 67 × 51 = 3417	**7.** 43 × 62 = 2666
8. 68 × 14 = 952	**9.** 81 × 18 = 1458	**10.** 66 × 15 = 990	**11.** 35 × 42 = 1470	**12.** 33 × 48 = 1584	**13.** 41 × 25 = 1025	**14.** 56 × 37 = 2072

15. 71 × 69 = 4899 **16.** 29 × 31 = 899 **17.** 75 × 34 = 2550 **18.** 15 × 32 = 480 **19.** 69 × 44 = 3036
20. 37 × 17 = 629 **21.** 25 × 28 = 700 **22.** 49 × 53 = 2597 **23.** 76 × 76 = 5776 **24.** 89 × 98 = 8722

Solve.

25. The Sky Pod on the CN Tower is 350 m above the ground. An elevator travels 6 m in each second. Can an elevator reach the Sky Pod in 58 s? no

***26.** The CN Tower is open for visitors 13 h each day during the winter months. How many hours is it open for visitors in February? 364

rcises: Remind the students to write Ex. 15-24 in vertical form. For Ex. 26, students will need to recall the number of days there are in February and whether the year involved is a leap year.

essment

tiply.

5	**2.** 73	**3.** 84	**4.** 61
6	29	28	55
0	2117	2352	3355

RELATED ACTIVITIES

- Students who are having difficulty may find it helpful to perform a multiplication in three parts as shown below for 23 × 16.

16	16	16
× 3	× 20	× 23
48	320	48
		320
		368

- Some students may be interested in finding products for a few exercises with the factors in the reverse order, as shown for Ex. 13. This is an illustration of the commutative property of multiplication, which may be used to check accuracy.

41	25
25	41
205	25
820	1000
1025	1025

Pages 240-241

OBJECTIVE

Demonstrate competence in multiplying a two-digit number by a two-digit number; solve related word problems

Practice

Multiply.

1. 26 × 14 = 364	**2.** 49 × 24 = 1176	**3.** 23 × 32 = 736
4. 54 × 53 = 2862	**5.** 78 × 43 = 3354	**6.** 37 × 74 = 2738
7. 85 × 28 = 2380	**8.** 16 × 61 = 976	**9.** 68 × 35 = 2380
10. 72 × 87 = 6264	**11.** 39 × 75 = 2925	**12.** 83 × 17 = 1411
13. 14 × 66 = 924	**14.** 96 × 48 = 4608	**15.** 52 × 26 = 1352
16. 47 × 98 = 4606	**17.** 88 × 31 = 2728	**18.** 97 × 42 = 4074
19. 76 × 34 = 2584	**20.** 95 × 33 = 3135	**21.** 94 × 13 = 1222
22. 64 × 64 = 4096	**23.** 92 × 81 = 7452	**24.** 71 × 22 = 1562
25. 54 × 15 = 810	**26.** 83 × 25 = 2075	**27.** 58 × 64 = 3712
28. 75 × 92 = 6900	**29.** 57 × 99 = 5643	**30.** 47 × 83 = 3901
31. 65 × 14 = 910	**32.** 77 × 55 = 4235	**33.** 51 × 96 = 4896
34. 82 × 47 = 3854	**35.** 63 × 27 = 1701	**36.** 83 × 51 = 4233
37. 52 × 19 = 988	**38.** 43 × 77 = 3311	**39.** 50 × 29 = 1450

240

Land is flat and highways are straight on the Prairies.

40. How far does a car travel in 13 h if it goes 95 km in each hour? 1235 km

41. It is 571 km from Winnipeg to Regina. Can a car that travels 85 km each hour make the trip in 7 h? yes

42. It is 1050 km across Manitoba and Saskatchewan. Can a car traveling 85 km each hour make the trip in 13 h? yes

43. If a car can travel 12 km on each litre of gasoline, how far can it travel on 90 L? 1080 km

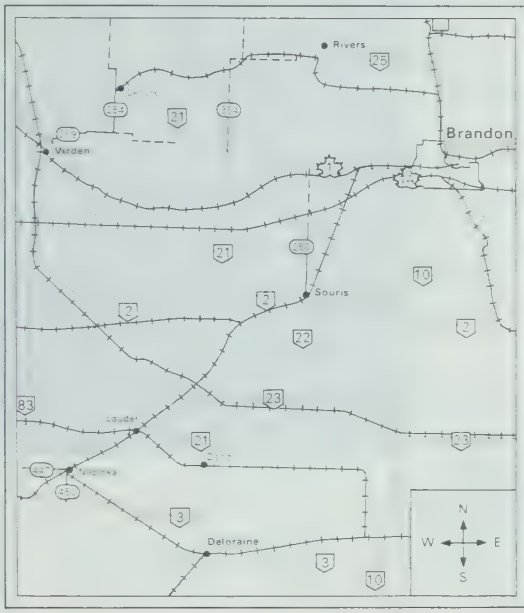
***44.** How much gasoline will a car need to go 1800 km if it uses 12 L to go 100 km? 216 L

LESSON ACTIVITY

Using the Pages

- Begin with a brief discussion of the photograph. Have students suggest in what part of Canada the photograph was taken. Then read the statement that precedes Ex. 40. You may wish to discuss the optical illusion that occurs in photographs such as this one. The road appears to narrow in the distance and lead toward a point, sometimes called a "vanishing point".
- You may wish to review the procedure of multiplying by a two-digit number by working a few of these exercises on the board with the students.
- The word problems deal with travelling by car and involve multiplication. Ex. 44 will provide a challenge for some students. If students suggest different ways of solving this problem, the solutions may be displayed for several days for other students to study.

Problem Solving: These exercises involve use of the ter *north*, *south*, *east*, and *west*. Ex. 1 and 2 may be answe in more than one way. Encourage the students to find most direct route in each case.



The numbers on the map are highway numbers. What directions would you give someone who wanted to go from Brandon

1. to Souris?
2. to Napinka?

Where would you be if you travel

3. south from Brandon on Highway 10, west on Highway 23, and then south on Highway 21 to the railroad? Dand

PROBLEM SOLVING

1. Go south on Highway 10 and then west on Highway 2.
2. Answers may vary. The most direct route is to go west on Highway 1 to the intersection with Highway 83. Go south on Highway 83 to the intersection with Highway 447. Go east on Highway 447 to the CP railway line that runs through Napinka

241

RELATED ACTIVITIES

- Some students may be interested in writing other exercises, similar to those in *Problem Solving*, for the map provided. Other students may solve the problems.

Also, you may wish to provide students with maps of their own area and have them write or answer questions related to the maps.

- Some maps show a chart that indicates distances between major towns and cities on the map. Have students pretend that they are driving at a speed of, for example, 75 km each hour and that they are driving for 7 h. Have them name three locations they can reach in that length of time if driving from a given city (or a city of their choice).

Pages 242-243

LESSON OUTCOME

Multiply a three-digit number by a multiple of ten from 10 to 90

Prerequisite Skills

Multiply a three-digit number by a one-digit number; multiply a two-digit number by a multiple of ten from 10 to 90

Checking Prerequisite Skills

Multiply.

1. 312 × 4 = 1248	**2.** 456 × 5 = 2280	**3.** 809 × 7 = 5663
4. 23 × 10 = 230	**5.** 62 × 30 = 1860	**6.** 57 × 70 = 3990

Multiplying Three-Digit Numbers by Multiples of Ten

In April, 60 VIA trains travel west across the mountains. Each one can carry 276 passengers. How many passengers can the VIA trains carry west across the mountains in April?

Multiply 60 and 276.

For the product

$$\begin{array}{r} 276 \\ \times\ 60 \\ \hline \end{array}$$

6 tens 0 ones

you need to know how to multiply 0 and 276

$$\begin{array}{r} 276 \\ \times\ 60 \\ \hline 0 \end{array}$$

When 0 is a factor, the product is 0.

and how to multiply 6 and 276.

$$\begin{array}{r} {\scriptstyle 4\ 3} \\ 276 \\ \times\ 60 \\ \hline 16560 \end{array}$$

6 tens × 276 = 1656 tens or 16 560.

The VIA trains can carry 16 560 passengers in April.

242

LESSON ACTIVITY

Using the Pages

- The procedure for multiplying a three-digit number by a multiple of ten is the same as for a two-digit number, with the multiplication carried out for one more place.

  Read the word problem and discuss why it can be solved using multiplication. Ask for another way of thinking of 60, and ask how this helps in carrying out the multiplication 60 × 276. Have a student explain the multiplication in terms of 6 tens × 276 to show what regrouping is involved.

  You may wish to have the students close their books and carry out the multiplication 60 × 276. Then they may check their work with the solution on page 242.

  Have a student read the concluding statement. You may wish to spend a few moments discussing the photograph of the VIA train and having students share their experiences of traveling by train.

Working Together: Ex. 1-3 lead the students to associ multiplying by a multiple of ten with multiplying b one-digit number. For each exercise, point out similarity in the first product and the last product emphasize that in multiplying by a multiple of ten, product shows 0 ones. This feature is further emphasize Ex. 4-6 to facilitate the multiplication. Have students sh their work on the board for Ex. 7-9 and explain the step

Exercises: Ex. 19-24 develop the pattern for the product of and a multiple of ten. The students are to follow the patt to tell what the next three products in the sequence will without actually carrying out the multiplications (Ex. 2 They may, of course, check their work by multiplying

Assessment

Multiply.

1. 251 × 30 = 7530	**2.** 179 × 20 = 3580	**3.** 208 × 60 = 12 480	**4.** 894 × 40 = 35 760

Working Together

Complete the first statement. Then use it to help you complete the other multiplication statements.

1. $3 \times 112 =$ 336
$3 \text{ tens} \times 112 =$ ___ tens 336
$30 \times 112 =$ 3360

2. $7 \times 574 =$ 4018
$7 \text{ tens} \times 574 =$ ___ tens 4018
$70 \times 574 =$ 40 180

3. 123 × 6 = 738
123 × 6 tens = 738 tens
123 × 60 = 7380

Write 0 in the ones place. Then multiply by 4 (tens).

4. 121 × 40 = 484

5. 237 × 40 = 9480

6. 695 × 40 = 27 800

Multiply.

7. 142 × 10 = 1420

8. 137 × 50 = 6850

9. 625 × 80 = 50 000

Exercises

Multiply.

1. 364 × 20 = 7280	**2.** 481 × 90 = 43 290	**3.** 274 × 50 = 13 700	**4.** 193 × 70 = 13 510	**5.** 822 × 80 = 65 760	**6.** 232 × 60 = 13 920
7. 876 × 40 = 35 040	**8.** 953 × 10 = 9530	**9.** 247 × 80 = 19 760	**10.** 966 × 50 = 48 300	**11.** 744 × 40 = 29 760	**12.** 396 × 80 = 31 680
13. 658 × 30 = 19 740	**14.** 276 × 90 = 24 840	**15.** 549 × 50 = 27 450	**16.** 825 × 30 = 24 750	**17.** 567 × 60 = 34 020	**18.** 448 × 70 = 31 360

Write the product for the two numbers in each cloud.

19. 99 × 10 = 990

20. 99 × 20 = 1980

21. 99 × 30 = 2970

22. 99 × 40 = 3960

23. 99 × 50 = 4950

24. 99 × 60 = 5940

25. What will the products be for the next three clouds?

6930
7920
8910

RELATED ACTIVITIES

- Have students complete tables and number wheels similar to the following (use copies of page T 360).

×	142
10	
20	
30	

Pages 244-245

LESSON OUTCOME

Multiply a three-digit number by a two-digit number

Prerequisite Skills

Multiply a three-digit number by a one-digit number; multiply a three-digit number by a multiple of ten from 10 to 90; interpret a two-digit numeral in terms of tens and ones

Checking Prerequisite Skills

Multiply.

1. 345 × 3 = 1035	**2.** 610 × 4 = 2440
3. 528 × 7 = 3696	**4.** 345 × 30 = 10 350
5. 610 × 40 = 24 400	**6.** 528 × 70 = 36 960

Complete.

7. 49 = 4 tens 9 ones

8. 53 = 5 tens 3 ones

9. 78 = 7 tens 8 ones

10. 82 = 8 tens 2 ones

Multiplying Three-Digit Numbers by Two-Digit Numbers

If a double-decker travels 225 km around Victoria each day, how far would it travel in the 92 d of June, July, and August?

Multiply 92 and 225.

For the product

$$\begin{array}{r} 225 \\ \times\ 92 \\ \hline \end{array}$$

9 tens 2 ones

you need to know how to multiply 2 and 225

$$\begin{array}{r} {\scriptstyle 1} \\ 225 \\ \times\ 92 \\ \hline 450 \end{array}$$

and how to multiply 9 and 225.

$$\begin{array}{r} {\scriptstyle 2\ 4} \\ 225 \\ \times\ 92 \\ \hline 450 \\ 20250 \end{array}$$

9 tens × 225 = 2025 tens or 20 250.

Then add.

$$\begin{array}{r} {\scriptstyle 2\ 4} \\ 225 \\ \times\ 92 \\ \hline 450 \\ 20250 \\ \hline 20700 \end{array}$$

The bus would travel 20 700 km in June, July, and August.

244

LESSON ACTIVITY

Before Using the Pages

- Review the procedure of multiplying a two-digit number by a two-digit number. Write on the board a few exercises similar to the following, and have students help to explain the steps.

$$\begin{array}{r} 26 \\ \times\ 32 \\ \hline 52 \\ 780 \\ \hline 832 \end{array}$$

1. Multiply 2 and 26.
2. Write 0 in the ones' place.
3. Multiply 3 and 26.
4. Add.

Tell the students that for today's lesson, the first factor will have three digits, and the same four steps will be used.

Using the Pages

- Have students suggest how the buses in this photograph differ from the bus in the photograph on page 228. Both are a means of transportation, but their use is different.

- Read the problem and discuss why it can be solved multiplication. Have students follow the worked exam explaining that 92 is thought of as 9 tens and 2 ones, that this suggests two multiplications, multiplying first b and then by 9 (tens). Have students perform the multipl tions orally to show the regrouping that is involved. particular attention to crossing out the regrouped num from multiplying 2 and 225. Ask why 0 is written in ones' place in multiplying 9 and 225. Ask a student to r the concluding statement.

  You may wish to have the students close their boo multiply 225 and 92, and then check their work with example on page 244.

Working Together: Ex. 1 and 2 describe the steps of procedure. Use other similar examples as required. For 3-7, the students are to think through the necessary st without assistance. Have the students space their exerc well on their page to allow room for writing the regroup numerals.

Working Together

Multiply by following the steps.

1.

873
× 15

Multiply 5 and 873. → 4 365
Write 0 in the ones place. → 8 730
Then multiply 1 and 873. → 13 095
Add.

1 ten × 873 = 873 tens.

2.

279
× 45

Multiply 5 and 279. → 1 395
Write 0 in the ones place. → 11 160
Then multiply 4 and 279. → 12 555
Add.

4 tens × 279 = 1116 tens.

Multiply.

3. 159 × 14 = 2226	**4.** 209 × 32 = 6688	**5.** 640 × 28 = 17 920	**6.** 700 × 52 = 36 400	**7.** 978 × 64 = 62 592

Exercises

Multiply.

1. 154 × 14 = 2156	**2.** 226 × 32 = 7232	**3.** 750 × 51 = 38 250	**4.** 282 × 26 = 7332	**5.** 194 × 19 = 3686	**6.** 617 × 82 = 50 594
7. 361 × 15 = 5415	**8.** 276 × 87 = 24 012	**9.** 267 × 82 = 21 894	**10.** 362 × 55 = 19 910	**11.** 600 × 12 = 7200	**12.** 762 × 44 = 33 528

Multiply like you multiply whole numbers.
Then write the result in dollars and cents.

Example:

$5.13
× 28
41 04 ← 8 × 513
102 60 ← 2 tens × 513
$143.64 ← Write the result in dollars and cents.

13. $9.12 × 34 = $310.08	**14.** $3.04 × 93 = $282.72
15. $4.62 × 71 = $328.02	**16.** $2.80 × 48 = $134.40
17. $2.87 × 67 = $192.29	**18.** $4.44 × 59 = $261.96

245

Exercises: Ex. 13-18 involve dollars and cents. An example is provided to demonstrate that the multiplication is carried out as for whole numbers, and that the result is written as dollars and cents. Depending on the level of the students in your class, you may discuss the example with them or have them study the example on their own.

Assessment

Multiply.

1. 416 × 31 = 896	**2.** 209 × 48 = 10 032	**3.** 640 × 76 = 48 640	**4.** 389 × 24 = 9336

RELATED ACTIVITIES

- Some students may benefit from completing multiplication in three steps as shown.

416 × 23 →

416 × 3	416 × 20	416 × 23
1248	8320	1248
		8320
		9568

- Have students complete multiplication exercises similar to the following.

123 × 10 = 1230	123 × 20 = 2460	123 × 30 = 3690	123 × 40 = 4920
123 × 5 = 615	123 × 6 = 738	123 × 7 = 861	123 × 8 = 984

When they have finished, have them use their answers to write the products for exercises similar to the following.

123 × 15 = 615 + 1230 = 1845	123 × 45	123 × 38

Pages 246-247

OBJECTIVE

Demonstrate competence in multiplying a three-digit number by a two-digit number

Practice

Multiply.

1. 177 × 14 = 2478	**2.** 298 × 27 = 8046	**3.** 691 × 33 = 22 803	**4.** 272 × 73 = 19 856	**5.** 314 × 26 = 8164	**6.** 218 × 66 = 14 388
7. 321 × 44 = 14 124	**8.** 346 × 53 = 18 338	**9.** 442 × 94 = 41 548	**10.** 651 × 19 = 12 369	**11.** 381 × 64 = 24 384	**12.** 188 × 72 = 13 536
13. \$5.26 × 42 = \$220.92	**14.** \$3.17 × 16 = \$50.72	**15.** \$2.49 × 23 = \$57.27	**16.** \$9.66 × 53 = \$511.98	**17.** \$1.52 × 98 = \$148.96	**18.** \$2.37 × 61 = \$144.57

As you do these, see if you can find a quick way to multiply by 11. See comments for Using the Pages.

19. 254 × 11 = 2794	**20.** 342 × 11 = 3762	**21.** 426 × 11 = 4686	**22.** 538 × 11 = 5918	**23.** 736 × 11 = 8096	**24.** 684 × 11 = 7524

What would the calculator show for each product?

25. 4179 × 913 = 3815 3127

26. 2184 × 915 = 1998 360

Here is a way to check multiplication.

137 → 1 + 3 + 7 → 11 → 1 + 1 → 2
23 → 2 + 3 → 5

411
2740
3151 → 3 + 1 + 5 + 1 → 10 → 1 + 0 → 1

If the product of these two numbers does not equal one of the numbers in red, there is a mistake in your work.

try this

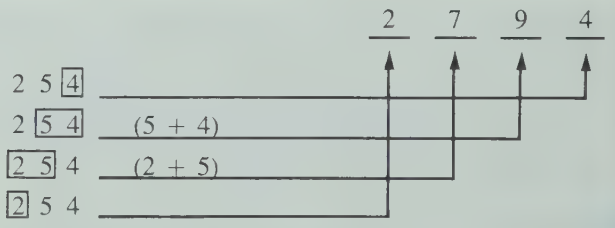
Use this method to check Exercises 1–6 above.

246

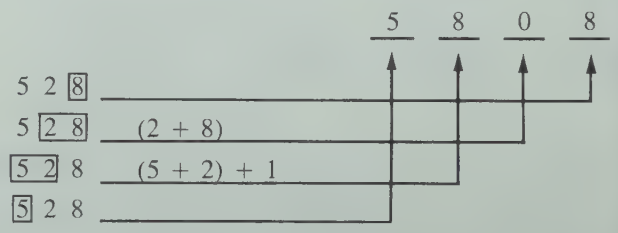
LESSON ACTIVITY

Using the Pages

- The photograph on page 247 can motivate a discussion of airplanes and air travel. Refer to the statement beneath the photograph and the related chart to discuss the different types of aircraft. Some students may know what type of aircraft they have flown on and may be able to describe flights they have taken.
- You may wish to review the steps of multiplying a three-digit number by a two-digit number by solving Ex. 27 on the board with the students.
- For Ex. 19-24, the students may discover a quick way to multiply by 11, using the sums of pairs of digits. For example, for 11 × 254, the digits 2, 5, and 4 can give the product 2794 as follows.



Regrouping may also be involved as in 11 × 528. The digits 2, and 8 can give the product 5808 as follows.



This DC-9 is one of 46 in the Air Canada fleet.

27. How many passengers could all the Air Canada DC-9's carry at one time? 4692

28. The DC-9 can fly 865 km in an hour. How far can it fly in 3 h? 2595 km

29. How many passengers could all the L-1011's carry at one time? 2928

30. In February, 28 747's and 28 L-1011's fly from Vancouver to eastern Canada. How many passengers could these flights carry in all? 18 844

31. Which can carry more passengers, 12 727's or 6 L-1011's? 12-727's

AIR CANADA JET FACTS*		
Type	Number	Seats
DC-8	27	205
DC-9	46	102
727	33	132
747	7	429
L-1011	12	244
*as of October, 1980.		

RELATED ACTIVITIES

- Some students may be interested in completing other exercises similar to Ex. 19-24, using the quick way to multiply by 11.

$$\begin{array}{rrrrr} 174 & 345 & 876 & 527 & 999 \\ \times\ 11 & \times\ 11 & \times\ 11 & \times\ 11 & \times\ 11 \end{array}$$

- Students may read advertisements in newspapers and magazines to select articles with prices to $9.99. They may then find the price they would pay to buy, for example, 24 of one item.
- Some students may be interested in finding a product, such as 24×99, in an indirect manner.

99 is close to 100 (1 less than 100).

$24 \times 100 = 2400$

Subtract: $24 \times 1 = 24$

$2400 - 24 = 2376$

Similarly, for 16×98,

98 is 2 less than 100.

$16 \times 100 = 1600$

Subtract: $16 \times 2 = 32$

$1600 - 32 = 1568$

This: The procedure described here will enable the students to check their multiplication by using simple addition and a basic multiplication fact. Note that in some instances, it is necessary to extend the procedure of adding digits. This is illustrated below for Ex. 1 and 4. You may wish to have the students test the procedure first for some of the worked examples in this unit. Suitable examples may be found on pages 228, 229, 230, 236, 238, 242, and 244.

1. $177 \rightarrow 1 + 7 + 7 \longrightarrow 15 \longrightarrow 1 + 5 \rightarrow 6$

$14 \rightarrow 1 + 4 \longrightarrow 5$

$2478 \rightarrow 2 + 4 + 7 + 8 \rightarrow 21 \rightarrow 2 + 1 \rightarrow 3 \qquad 30 \rightarrow 3 + 0 \rightarrow 3$

4. $272 \rightarrow 2 + 7 + 2 \rightarrow 11 \rightarrow 1 + 1 \longrightarrow 2$

$73 \rightarrow 7 + 3 \longrightarrow 10 \rightarrow 1 + 0 \longrightarrow 1$

$19\,856 \rightarrow 1 + 9 + 8 + 5 + 6 \rightarrow 29 \rightarrow 2+9 \rightarrow 11 \rightarrow 1 + 1 \rightarrow 2$

Page 248

OBJECTIVE

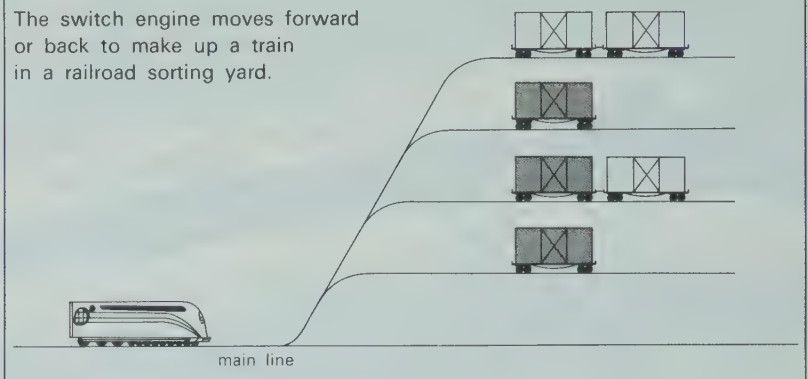
Solve a problem through a process of logical thinking

RELATED ACTIVITIES

- Some students may enjoy arranging a chess or checker tournament for interested members of the class.
- Display the problems written by the students for Ex. 7 so that many students may attempt solutions for them.
- For exercises in logical reasoning, activities involving the use of attribute blocks is recommended (see page xxiv). Several activities are described on page T 346.

Logical Thinking

The switch engine moves forward or back to make up a train in a railroad sorting yard.



Count each move going forward as one move.
Count each move going back as one move.
How many moves are needed to get

1. 4 cars to the main line? 4
2. all the cars to the main line? 8
3. all the red cars and no white cars to the main line? 6
4. all the white cars and no red cars to the main line? 8
5. all the cars like this on the main line? 10

There is room for just 1 car on the siding.

6. How can the switch engine change places with the caboose?
7. Draw railroad tracks and make up a switching problem for a friend.

PROBLEM SOLVING

See the solution given below in Using the Page.

248

LESSON ACTIVITY

Using the Page

- Explain that some problems are not solved by completing an exercise, for example, a multiplication exercise. Suggest that certain problems, similar to the ones they are about to experience on this page, depend on a process described as "logical thinking". Suggest, for example, that games such as chess and checkers involve logical thinking. Games that involve dice may also involve logical thinking, but they also depend on chance because of the use of the dice (Backgammon, for example). Some games depend on chance alone (Snakes and Ladders, for example).
- Read the statement that introduces the situation and, if necessary, explain the role of a switch engine in a railroad sorting yard. These exercises can be left with the students for several days, and the solutions may then be shared and discussed orally. Some students may find it helpful to use blocks of two different colors to represent railroad cars a manipulate the blocks in considering solutions to t problems. One possible answer for Ex. 6 is given belov

The engine moves the car and the caboose onto t siding, leaving the caboose there. The engine and the c move to the main line left of the siding and then to the rig of the siding. The engine and the car go back onto t siding, the car is left there, and the caboose is pushed to t main line. The engine moves to the right, backs onto t siding, picks up the car, and returns to the main line. T engine and the caboose have changed places.

Checking Up

Choose the best estimate for each product.

1. 198 × 6 — 120 / (1 200) / 12 000

2. 81 × 5 — 40 / (400) / 4000

3. 392 × 7 — 280 / 2100 / (2800)

4. 570 × 9 — 450 / 4500 / (5400)

Round the two-digit factors to the nearest ten.
Round the three-digit factors to the nearest hundred.
Then multiply to estimate each product.

5. 124 × 4 = 400 **6.** 799 × 3 = 2400 **7.** 46 × 7 = 350 **8.** 177 × 4 = 800 **9.** 809 × 9 = 7200 **10.** 33 × 6 = 180

Multiply.

11. 4 × 21 84 **12.** 5 × 360 1800 **13.** 6 × 265 1590 **14.** 9 × 29 261 **15.** 7 × 455 3185
16. 40 × 22 880 **17.** 30 × 96 2880 **18.** 80 × 63 5040 **19.** 20 × 891 1780 **20.** 60 × 382 2280

21. 133 × 50 = 6650 **22.** 854 × 70 = 59 780 **23.** 515 × 90 = 46 350 **24.** 606 × 80 = 48 480 **25.** 900 × 60 = 54 000 **26.** 288 × 20 = 5760
27. 45 × 25 = 1125 **28.** 36 × 17 = 612 **29.** 63 × 74 = 4662 **30.** 96 × 35 = 3360 **31.** 54 × 48 = 2592 **32.** 20 × 56 = 1120
33. 818 × 42 = 34 356 **34.** 974 × 16 = 15 584 **35.** 400 × 80 = 32 000 **36.** $7.66 × 62 = $474.92 **37.** $5.02 × 39 = $195.78 **38.** $5.20 × 52 = $270.40

Solve.

39. 32 passengers ride in each bus. How many ride in 16 buses? 512

40. 73 airplanes land each day. How many land in 7 d? 511

41. A ferry can carry 54 cars. How many cars can it carry in 14 trips? 756

42. 375 passengers ride the train each day. How many ride the train in 28 d? 10 500

43. Tickets cost $23 each. How much do 18 tickets cost? $414

44. Some tickets cost $8.75 each. How much do 42 of these cost? $367.50

249

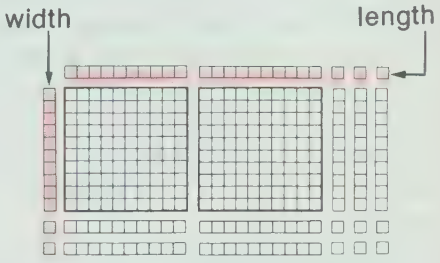
Page 249

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Some students may be interested in using base-ten Arithmetic Blocks (hundreds, tens, and ones) or graph paper to investigate the product of two two-digit factors. The following diagram illustrates that the product of 23 and 12 is 276.



Briefly, 2 tens 3 ones are arranged to represent the length of a rectangle, and 1 ten 2 ones are arranged to represent the width. The interior of the rectangle is then filled using as many hundreds as possible, then tens, and finally ones. These are then counted to determine the product, in this case, 276, for 2 hundreds, 7 tens, 6 ones.

kills	Exercises	Related Pages
stimate a product	1-10	T 252-T 253
ultiply a two-digit number by a one-digit number	11, 14	T 246-T 247
ultiply a three-digit number by a one-digit number	12, 13, 15	T 248-T 249
ultiply a two-digit number by a multiple of ten from 10 to 90	16-20	T 254-T 255
ultiply a three-digit number by a multiple of ten from 10 to 90	21-26	T 260-T 261
ultiply a two-digit number by a two-digit number	27-32	T 256-T 257
ultiply a three-digit number by a two-digit number	33-38	T 262-T 263
olve multiplication problems	39-44	

Comments

Errors in multiplication may result from errors in one or more of the following: completing basic multiplication facts; showing 0 ones in multiplying by the number of tens; regrouping in multiplying; adding the partial products.

Determine specific causes of errors and provide remedial assistance to groups or to individuals. The steps outlined in *Working Together* for many lessons of this unit may be helpful in reteaching or reviewing.

Unit 11 Overview

Division

The operation of division is continued from the level achieved in Unit 6 where divisors and quotients were single digits. In this unit the standard algorithm is developed more fully as the means of dividing up to three-digit dividends, with remainders. The important relationships between basic multiplication facts and division facts are reviewed, and emphasis is placed upon the use of multiplication and subtraction in the procedures. In the early stages the partial quotients for each place value of the dividend are stacked above the dividend and then added to get the actual quotient. Later in the unit the shorter form of recording the quotient in one line is shown. Finding an average is presented as an application of division in everyday life. Two *Try This* features present prime factors and checking division by multiplication. Three *Problem Solving* features include one lesson on the possibility of a problem having more than one correct solution and two smaller items which, although different in some respects, support the theme of the major lesson. The exercises in two *Keeping Sharp* features maintain skills in adding and subtracting whole numbers and also one-place and two-place decimals.

Prerequisite Skills

- complete basic multiplication facts
- use multiplication to complete basic division facts
- multiply multiples of ten by one-digit numbers, products to 90
- multiply a multiple of one hundred by a one-digit number, products to 900
- find the quotient and remainder, divisors and quotients to 9
- regroup with numbers to 999

Unit Outcomes

- use multiplication to divide, divisors and quotients to 9, remainders
- divide a multiple of ten from 10 to 90 by a one-digit number, quotients are multiples of ten
- divide a two-digit number by a one-digit number, no regrouping, remainder zero
- divide a three-digit number by a one-digit number, no regrouping, remainder zero
- divide a two-digit number by a one-digit number, regrouping tens as ones, remainder zero
- divide a three-digit number by a one-digit number, regrouping tens as ones, remainder zero
- divide a three-digit number by a one-digit number, regrouping hundreds as tens, quotients to 99, remainder zero
- divide a three-digit number by a one-digit number with two regroupings, remainders
- use division to find an average
- use a shorter form for division
- solve problems having more than one solution

Background

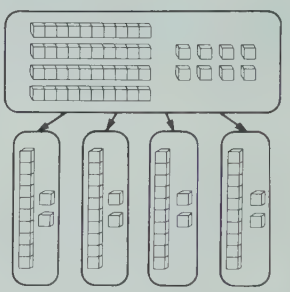
Long division is probably the most difficult of the computational algorithms for many teachers and students. The students need understanding and skill in using the sub-skills of numeration and place value, subtraction, and multiplication, and they need to understand how these are combined in the division algorithm.

The most commonly used algorithm is sometimes known the *distributive method* because it involves dividing each pla value of the dividend in succession. In Unit 6 the differenc between sharing (partitive) and measurement (quotitive) divisi are outlined. The same algorithm is used for both types division relationships, but the partitive approach is particula helpful in developing the distributive division algorithm.

In the textbook, the word *share* is used in connection with distributive method. For instance, $4\overline{)48}$ is interpreted "share among 4 groups" which can then be thought of as "share 4 te and then 8 ones". This permits the use of models to repres place values in the dividend.

$$\begin{array}{r} 2 \\ 10 \end{array} \rightarrow 12$$

$$\begin{array}{r} 4\overline{)48} \\ 40 \\ \hline 8 \\ 8 \\ \hline 0 \end{array} \quad \begin{array}{l} \\ 4 \times 1 \text{ ten} \\ \\ 4 \times 2 \\ \end{array}$$



It is most important to think of the dividend and the quoti in terms of place value. Each stage of dividing the divide results in a number for the quotient. At first, these numbers stacked above the dividend in their proper places, as 10 and 2 the example above. It is important that the 4 of 48 be interpre as 4 tens and the 1 in the quotient 10 be interpreted as 1 t particularly when the shorter form of writing the quotient in line is presented.

It is relatively easy to divide two-place and three-pla numbers when each place value is a multiple of the divisor. cases like $3\overline{)639}$ an algorithm is hardly necessary; but when digits in the dividend are not multiples of the divisor as in $3\overline{)7}$ and especially when the first digit on the left is less than divisor as in $3\overline{)246}$, a meaningful approach based on place va is required. It is necessary to interpret the dividend in more th one way. For example, for $3\overline{)246}$:

$$\begin{array}{r} 2 \\ 80 \end{array} \rightarrow 82$$

246 = 2 hundreds 4 tens 6 ones	$3\overline{)246}$
2 hundreds cannot be shared in	$\underline{240}$
3 equal parts for each part to	6
have at least 1 hundred	$\underline{6}$
246 = 24 tens 6 ones	0

The dividend must be considered as 24 tens 6 ones, a therefore the first partial quotient is a number of tens rather th a number of hundreds. As stated earlier, this proced emphasizing place value is even more important when one-l quotients are used. Students, before they write anything ir one-line quotient, can determine how many digits there will by knowing the place value of the first digit of the quotient. T knowledge can help to prevent such errors as omitting the 0 fo tens in the quotient for a division similar to the following, and writing the quotient 28 rather than 208. Since the first digit of the quotient is in the hundreds' place, there will be three digits in the quotient. Specifically, if the first digit represents tens, there will be two digits; if it represents hundreds, there will be three digits, and so on.

$$\begin{array}{r} 208 \\ 4\overline{)832} \\ \underline{800} \\ 32 \\ \underline{32} \\ 0 \end{array}$$

the Overview for Unit 6, it is pointed out that division is
ed to repeated subtraction: repeated subtraction of the
or, either singly or in multiples, can be used to find a
ent. Both subtraction and multiplication are used in the
lard algorithm.

ultiplication facts are used extensively in determining digits
e quotient, but multiplication is also used to produce
iples of the divisor which can then be
acted. At this level of using the algorithm,
subtraction is from the entire dividend and
remainder becomes a new dividend until it is
than the divisor. For example, in $4\overline{)937}$, the
dividend is 937, the next dividend is 137, the
is 17, and the remainder 1 is less than the
or, 4. The shorter procedure of the standard
rithm eliminates the zeros in the numbers 800
120; this level is reached in *Starting Points in
nematics 5*.

$$\begin{array}{r} 234 \\ 4\overline{)937} \\ \underline{800} \\ 137 \\ \underline{120} \\ 17 \\ \underline{16} \\ 1 \end{array}$$

epending on the background of the students in your class,
e may have been introduced to the procedure of "side
king" division. This involves thinking of the divisor as the
ber in each group and the quotient as the number of groups.
s, for $3\overline{)72}$, the question is asked, "How many groups of
are in seventy-two?" The quotient can be obtained in
rent ways by a series of subtractions. Possible solutions to
e stacking" division exercises look like this.

$$\begin{array}{r|l} 24 & \\ 3\overline{)72} & \\ \underline{60} & 20 \\ 12 & \\ \underline{12} & \underline{4} \\ 0 & 24 \end{array}$$

B

$$\begin{array}{r|l} 327 & \\ 3\overline{)981} & \\ \underline{900} & 300 \\ 81 & \\ \underline{60} & 20 \\ 21 & \\ \underline{21} & \underline{7} \\ 0 & 327 \end{array}$$

he transition from this method to our method and then to the
rithm is a smooth one if you direct the students to think of
e value and then guide them by asking questions about
ing the hundreds, tens, and ones. Thus, the solution for
mple B will be written as shown for C.

$$\begin{array}{r} 7 \\ 20 \\ 300 \end{array}\Big\rceil \rightarrow 327$$

$$\begin{array}{r} 3\overline{)981} \\ 900 \\ \hline 81 \\ 60 \\ \hline 21 \\ 21 \\ \hline 0 \end{array}$$

D

$$\begin{array}{r} 327 \\ 3\overline{)981} \\ 900 \\ \hline 81 \\ 60 \\ \hline 21 \\ 21 \\ \hline 0 \end{array}$$

he last stage in the development of the algorithm,
esented by example D, is reached by the end of Unit 11.
he meaning of each of the terms *prime number* and
posite number is discussed in the Overview for Unit 6 on
es T 136 and T 137. You may wish to reread that section at
time. In this unit, the *Try This* feature on page 252 looks at
e numbers as factors, in other words, *prime factors*. (Recall
1 is not a prime number and thus cannot be considered a
prime factor.) Any composite number may be expressed as the product of two factors; for example,

$6 = 2 \times 3$ (two prime factors)
$12 = 3 \times 4$ (one prime factor, one composite factor)
$36 = 4 \times 9$ (two composite factors)

A composite number can, however, be expressed in terms of all its prime factors. To find the prime factors of 24, express 24 as 6×4 and factor the composite factors to give $3 \times 2 \times 2 \times 2$ as a product of the prime factors of 24. Thus 2 and 3 are *the prime factors* of 24.

A composite number may be expressed as the product of two factors in several ways. This is true because it has only one set of prime factors and because the associative property of multiplication can be applied in grouping factors in various ways; for example,

$$\begin{aligned} 24 &= 2 \times (2 \times 2 \times 3) \\ &= 2 \times 12 \\ 24 &= (2 \times 2 \times 2) \times 3 \\ &= 8 \times 3 \\ 24 &= (2 \times 2) \times (2 \times 3) \\ &= 4 \times 6 \end{aligned}$$

Teaching Strategies

Success in using the division algorithm is dependent on the use of three essential components blended into a meaningful procedure: numeration, subtraction, and multiplication. Students need sufficient mastery of the number facts and understanding of the operations so that they can devote their attention almost exclusively to their integration in the algorithm. It is strongly recommended that these sub-skills be reviewed thoroughly before beginning the work of this unit on division.

The numeration ideas which have the most value concern renaming numbers in terms of lesser place values. For example, for $8\overline{)63}$, 6 tens 3 ones is renamed as 63 ones, and for $4\overline{)327}$, 3 hundreds 2 tens is renamed as 32 tens. Students need to be able to rename any two-digit number as only ones, and any three-digit number in terms of only two places, tens and ones. This ability is essential in every case where the divisor is greater than the first digit of the dividend, as in the preceding examples.

Skills in subtraction and multiplication are also required, and students should have complete mastery of the basic facts in these two operations and sufficient competence in performing the operations with numbers. It may be necessary to provide extra practice in these two areas to strengthen the skills, especially when renaming is required. Students with similar needs should be grouped and provided with appropriate practice exercises.

Models of hundreds, tens, and ones are useful in the early stages of the development (use copies of page T 362). Also, it may be helpful to work some examples with place names in the algorithms. This method parallels the actual manipulation of models and may be shown for exercises with and without remainders.

Materials

models for hundreds, tens, and ones
tracing paper for each student
copies of pages T 367 and T 368

Vocabulary

prime factors average

Pages 250-251

LESSON OUTCOME

Use multiplication to divide, divisors and quotients to 9, remainders

Prerequisite Skills

Complete basic multiplication facts

Checking Prerequisite Skills

Multiply.

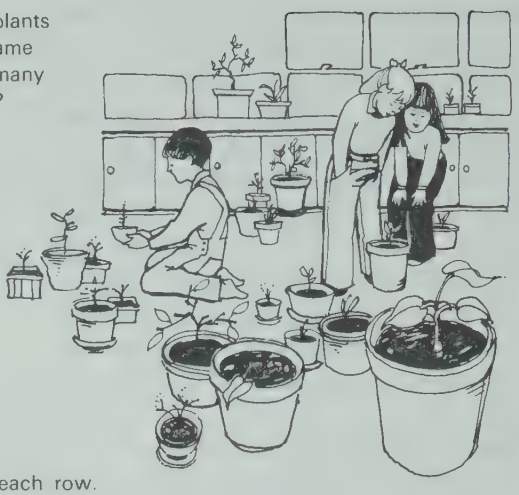
1.	2.	3.	4.
4	3	9	8
7	5	6	8
28	15	54	64

5. 2×7 14
6. 3×4 12
7. 9×1 9

11 DIVISION

Using Multiplication to Divide

The teacher wanted the 24 plants placed in 4 rows with the same number in each row. How many would there be in each row?



Divide 24 by 4.

For $4\overline{)24}$

think $4 \times \quad = 24$
$4 \times 6 = 24$

Write $\begin{array}{r} 6 \\ 4\overline{)24} \end{array}$

There would be 6 plants in each row.

Working Together

Complete these multiplication tables.

1.

×	1	2	3	4	5	6	7	8	9
2	2	4	6	8	10	12	14	16	18

2.

×	1	2	3	4	5	6	7	8	9
3	3	6	9	12	15	18	21	24	27

3.

×	1	2	3	4	5	6	7	8	9
4	4	8	12	16	20	24	28	32	36

4.

×	1	2	3	4	5	6	7	8	9
5	5	10	15	20	25	30	35	40	45

Which multiplication fact could be used to find the quotient?

5. $2\overline{)16}$ $2 \times 8 = 16$ $4 \times 7 = 28$
6. $24 \div 3$ $3 \times 8 = 24$ $4 \times 6 = 24$
7. $28 \div 4$
8. $4\overline{)27}$

$4 \times 7 = 28$	$4 \times 6 = 24$
$2 \times 8 = 16$	$3 \times 8 = 24$

Find the quotient. Give the multiplication fact you use.

9. $3\overline{)21}$ 7, $3 \times 7 = 21$
10. $35 \div 5 = 7$ $5 \times 7 = 35$

Find the quotient and the remainder. Give the multiplication fact you use.

11. $3\overline{)10}$ 3 R1, $3 \times 3 = 9$
12. $5\overline{)32}$ 6 R2, $5 \times 6 = 30$

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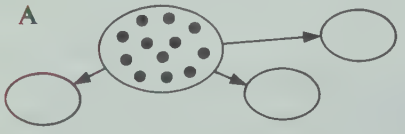
LESSON ACTIVITY

Before Using the Pages

- You may wish to review the partitive aspect of division and the use of arrays in finding quotients. For example, draw diagram A on the board and have students complete it to show 12 shared equally among 3. Also, have them draw 20 X's on 4 lines so that the same number of X's are on each line as in B. Have students recall that a division fact can be written for each diagram. Then suggest that division can be completed more efficiently by thinking of the related operation, multiplication.

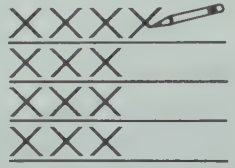
A



$\begin{array}{r} ? \\ 3\overline{)12} \end{array}$

$3 \times \square = 12$

B



$\begin{array}{r} ? \\ 4\overline{)20} \end{array}$

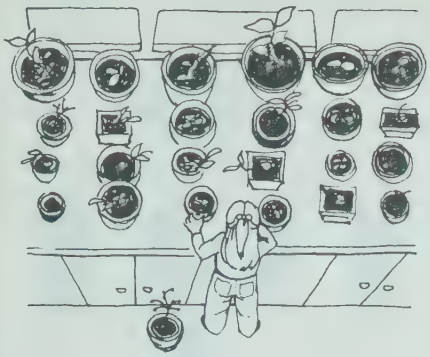
$4 \times \square = 20$

Using the Pages

- The example at the top of page 250 reviews the use multiplication to divide. The worked example at the to page 251 reviews the formal division algorithm and manner of showing the remainder. Discuss each exam emphasizing that multiplication can be used to find quotient. Review the terms *quotient* and *remainder*.

Working Together: Ex. 1-4 review basic multiplication f for which the first factor is 2, 3, 4, or 5. Students may r to the completed tables for assistance in answering 5-12. Ex. 5-8 emphasize selecting an appropriate multi cation fact to find a quotient with 0 as the remainder (Ex 6, 7) and with a remainder greater than 0 (Ex. 8). Ex. 9 involve using multiplication to divide.

Exercises: By completing the table in Ex. 1, students have the necessary multiplication facts available for re reference (including those from Ex. 1-4, on page 25 Note that Ex. 2-7 require the students to write multiplication facts used to find the quotients. This help



If there were 25 plants in the room, they could be placed in 4 rows of 6 with 1 plant left over.

$$4\overline{)25}\quad 6\ \text{R}1,\quad 24,\quad 1$$

In division, the number left over is the remainder.

Exercises

Complete this multiplication table.

1.

×	1	2	3	4	5	6	7	8	9
6	6	12	18	24	30	36	42	48	54
7	7	14	21	28	35	42	49	56	63
8	8	16	24	32	40	48	56	64	72
9	9	18	27	36	45	54	63	72	81

Find the quotient. Write the multiplication fact you use.

2. $6\overline{)24}$ (4; $6\times4=24$) **3.** $7\overline{)56}$ (8; $7\times8=56$) **4.** $27\div9=3$ ($9\times3=27$)

Find the quotient and the remainder. Write the multiplication fact you use.

5. $8\overline{)74}$ (9 R2; $8\times9=72$) **6.** $59\div6$ (9 R5; $6\times9=54$) **7.** $8\overline{)52}$ (6 R4; $8\times6=48$)

Show the quotient for each division.

8. $3\overline{)18}$ (6) **9.** $8\overline{)24}$ (3) **10.** $2\overline{)14}$ (7) **11.** $9\overline{)54}$ (6) **12.** $5\overline{)25}$ (5) **13.** $7\overline{)42}$ (6)

14. $4\overline{)12}$ (3) **15.** $9\overline{)18}$ (2) **16.** $5\overline{)45}$ (9) **17.** $7\overline{)21}$ (3) **18.** $4\overline{)32}$ (8) **19.** $8\overline{)64}$ (8)

20. $10\div5$ (2) **21.** $30\div6$ (5) **22.** $40\div5$ (8) **23.** $63\div7$ (9) **24.** $15\div3$ (5) **25.** $48\div6$ (8)

Show the quotient and the remainder.

26. $4\overline{)33}$ (8 R1) **27.** $8\overline{)42}$ (5 R2) **28.** $5\overline{)17}$ (3 R2) **29.** $9\overline{)75}$ (8 R3) **30.** $3\overline{)29}$ (9 R2) **31.** $6\overline{)17}$ (2 R5)

32. $3\overline{)11}$ (3 R2) **33.** $7\overline{)50}$ (7 R1) **34.** $9\overline{)50}$ (5 R5) **35.** $8\overline{)22}$ (2 R6) **36.** $6\overline{)41}$ (6 R5) **37.** $7\overline{)32}$ (4 R4)

Choose three of the four numbers and write a division fact.

38. 7, 9, 36, 63 ($63\div9=7$) **39.** 36, 6, 4, 9 ($36\div9=4$) **40.** 56, 54, 6, 9 ($54\div9=6$) **41.** 42, 13, 6, 7 ($42\div6=7$)

42. 7, 35, 28, 5 ($35\div7=5$) **43.** 18, 9, 9, 2 ($18\div9=2$) **44.** 54, 8, 7, 56 ($56\div8=7$) **45.** 9, 8, 81, 9 ($81\div9=9$)

The other division fact for each of Ex 38-44 is acceptable.

RELATED ACTIVITIES

- For further practice and review, have students complete tables similar to the following. The difficulty can be varied according to the ability of the students.

×	7			3		4
5		10	40		45	

×	6	4		3
			64	
9			72	
				15
42				

- For practice in relating multiplication and division, provide students with a set of three numbers and have them write a family of multiplication and division facts.

$4\times9=36$
$9\times4=36$

$4\overline{)36}$ (9) $\quad 9\overline{)36}$ (4)

- Number wheels similar to the following will provide practice in division. (You may wish to use copies of page T 360.)

emphasize the inverse relationship between division and multiplication. For Ex. 6, the students will likely rewrite the division $59\div6$ in the form $6\overline{)59}$. Although both division symbols are reviewed in this lesson, the symbol $\overline{)}$ is emphasized hereafter for use in the formal algorithm.

For each of Ex. 38-45, one of the four numbers does not belong to the group. These exercises provide another way of relating multiplication and division. For example, for Ex. 38, a student may think $7\times9=63$ or $9\times7=63$, and find that 36 is not useful. For the division fact, either $63\div7=9$ or $63\div9=7$ may be written.

sessment

d the quotient. Write the multiplication fact you use.

20 ÷ 4 (5; $4\times5=20$) **2.** $3\overline{)21}$ (7; $3\times7=21$)

d the quotient and the remainder. Write the multiplication t you use.

32 ÷ 5 (6 R2; $5\times6=30$) **4.** $2\overline{)11}$ (5 R1; $2\times5=10$)

Find the quotient.

5. $6\overline{)48}$ (8) **6.** $8\overline{)32}$ (4)

Find the quotient and the remainder.

7. $9\overline{)22}$ (2 R4) **8.** $7\overline{)50}$ (7 R1)

Page 252

LESSON OUTCOME

Divide a multiple of ten from 10 to 90 by a one-digit number, quotients are multiples of ten

Materials

models for tens

Vocabulary

prime factors

Prerequisite Skills

Multiply a multiple of ten by a one-digit number, products to 90; use multiplication to complete basic division facts

Checking Prerequisite Skills

Complete.

1.	2.	3.
30	20	10
× 3	× 4	× 7
90	80	70

Divide. Write the multiplication fact you use.

4.	5.	6.
4	1	3
2)8	6)6	3)9
2 × 4 = 8	6 × 1 = 6	3 × 3 = 9

RELATED ACTIVITIES

- You may wish to have children investigate prime numbers less than 100 at this time if they did not do so earlier in Unit 6. The activity is described on page T 347.

Sharing Tens

Divide 80 by 4.

For $4\overline{)80}$,

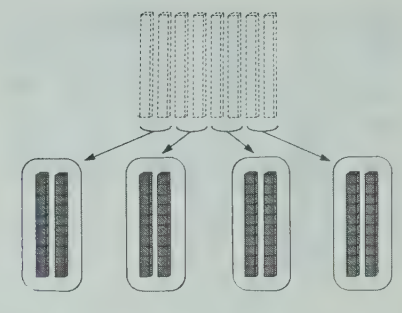
share 80, or 8 tens, among 4 groups.

Think

$4 \times 2 = 8$
$4 \times 2 \text{ tens} = 8 \text{ tens}$
$4 \times 20 = 80$

Write $4\overline{)80}$ (20)

When 80 is divided by 4, the quotient is 20.



Working Together

How many tens?

1. 60 (6) 2. 70 (7) 3. 90 (9)

Divide.

4. $2\overline{)60}$ (30) 5. $7\overline{)70}$ (10) 6. $3\overline{)90}$ (30)

Exercises

Divide.

1.	2.	3.
20	10	10
3)60	5)50	8)80
4.	**5.**	**6.**
20	30	30
4)80	2)60	3)90
7.	**8.**	**9.**
20	10	40
2)40	3)30	2)80

Solve.

10. Earl spent 40¢ for 4 oranges. How much did each orange cost? (10¢)

11. Jackie has 3 shelves for her 60 books. She wants to put the same number on each shelf. How many books should she put on each shelf? (20)

2 and 3 are prime numbers.

$2 \times 3 = 6$

2 and 3 are **prime factors** of 6.

6 and 5 are factors of 30.
6 is not a prime factor of 30 because 6 is not a prime number.

2, 3, and 5 are the prime factors of 30.

$6 \times 5 = 30$
$2 \times 3 \times 5 = 30$

List the prime factors for each of these.

1. 10	2. 14	3. 21
4. 15	5. 35	6. 42
7. 12	8. 18	9. 63

try this

1. 2,5 2. 2,7 3. 3,7
4. 3,5 5. 5,7 6. 2,3,7
7. 2,3 8. 2,3 9. 3,7

LESSON ACTIVITY

Before Using the Page

- Have students work in small groups using up to 9 tens in each group. Have them share 8 tens in 4 equal groups, 6 tens in 2 equal groups, 4 tens in 4 equal groups, and so on. For each example, ask, "How many tens are in each group?" and "What number is named by _____ tens?"

Using the Page

- In the worked example, $4\overline{)80}$ is interpreted as 8 tens shared equally among 4 groups, and the diagram shows that there are 2 tens in each group. At the same time, it is demonstrated that multiplication can be used to find the quotient. The basic multiplication fact $4 \times 2 = 8$ is extended to 4×2 tens $= 8$ tens, or $4 \times 20 = 80$. Emphasize that using multiplication is an efficient way of finding the quotient.

Working Together: Ex. 1-3 emphasize thinking of a multiple of ten as a number of tens, for example, 60 is 6 tens. This helps students to relate a division such as $2\overline{)60}$ (Ex. 4) t basic multiplication fact, in this case, $2 \times 3 = 6$ and extension 2×3 tens $= 6$ tens, and thus $6 \div 2 = 3$ an tens $\div 2 = 3$ tens. Note that the numbers in Ex. 1-3 the same as the dividends in Ex. 4-6. As the stude complete Ex. 4-6, have them think in terms of tens, example, for Ex. 5, $7\overline{)70}$ is thought of as $7\overline{)7}$ tens.

Exercises: You may wish to remind the students to write answers for Ex. 10 and 11 in sentences.

Try This: The *Try This* feature on page 145 introduced stude to the concept of prime numbers. This is extended here an investigation of the *prime factors* of a number. Revi that 1 is not a prime number. If you wish, review manner of determining whether a number is prime (or re the students to *Try This* on page 145).

Assessment

Divide.

1.	2.	3.	4.
10	20	10	20
2)20	4)80	6)60	2)40

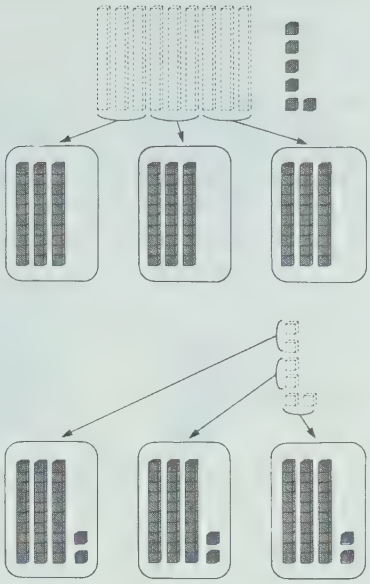
Sharing Tens and Ones

Divide 96 by 3.
96 equals 9 tens 6 ones.

For $3\overline{)96}$, share the 9 tens first.

Think
$3 \times 3 = 9$
3×3 tens $= 9$ tens
$3 \times 30 = 90$

Write
$$\begin{array}{r} 30 \\ 3\overline{)96} \\ 90 \\ \hline 6 \end{array}$$
6 still to share



Then, share the 6 ones.

Think
$3 \times 2 = 6$

Write
$$\begin{array}{r} 2 \\ 30 \\ 3\overline{)96} \\ 90 \\ \hline 6 \\ 6 \\ \hline 0 \end{array}$$

Add for the quotient.
$$\begin{array}{r} 2 \\ 30 \\ 3\overline{)96} \\ 90 \\ \hline 6 \\ 6 \\ \hline 0 \end{array} \rightarrow 32$$

When 96 is divided by 3, the quotient is 32.

Working Together

How many tens? How many ones?

1. 48 (4 tens 8 ones)
2. 66 (6 tens 6 ones)
3. 80 (8 tens 0 ones)

Divide.

4. $2\overline{)48}$ (24)
5. $6\overline{)66}$ (11)
6. $4\overline{)80}$ (20)

Exercises

Divide.

1. $2\overline{)62}$ (31)
2. $3\overline{)69}$ (23)
3. $2\overline{)24}$ (12)
4. $4\overline{)88}$ (22)
5. $7\overline{)77}$ (11)
6. $4\overline{)40}$ (10)
7. $3\overline{)36}$ (12)
8. $2\overline{)86}$ (43)
9. $3\overline{)93}$ (31)

253

Page 253

LESSON OUTCOME

Divide a two-digit number by a one-digit number, no regrouping, remainder zero

Materials

models for 9 tens and 9 ones

Prerequisite Skills

Multiply a multiple of ten by a one-digit number, products to 90; use multiplication to complete basic division facts

Checking Prerequisite Skills

Multiply.

1. 4×20 (80)
2. 2×30 (60)
3. 6×10 (60)

Divide. Write the multiplication fact you use.

4. $4\overline{)8}$ (2) $4 \times 2 = 8$
5. $9\overline{)9}$ (1) $9 \times 1 = 9$
6. $3\overline{)6}$ (2) $3 \times 2 = 6$

RELATED ACTIVITIES

- You may wish to have the students check their divisions by using multiplication.
- Exercises similar to the following may help those students having difficulty with the written format.

$$\begin{array}{r} 3 \\ 2\overline{)86} \\ 80 \\ \hline 6 \end{array} \rightarrow 43$$

LESSON ACTIVITY

Before Using the Page

Write several division exercises on the board, such as $3\overline{)60}$, $2\overline{)40}$, $3\overline{)63}$, $2\overline{)48}$. Have the students use models to find the quotients by sharing. Discuss that some exercises involve sharing only tens, whereas others involve sharing tens and ones.

Review the written format for a division such as $3\overline{)60}$. Emphasize that using multiplication helps to find the quotient. Suggest that a division involving tens and ones can also be completed by using multiplication.

Using the Page

The diagrams of the worked example illustrate the two steps of sharing 96 among 3 groups (share the tens and share the ones). At the same time, the corresponding steps in the division algorithm are highlighted with red on the numerals. Discuss that 96 is 9 tens 6 ones, and emphasize that the tens are shared first. Ask what multiplication fact helps to find $3\overline{)9 \text{ tens}}$. Relate the numbers 30 and 90 to the diagram showing 3 tens (or 30) in each group and 9 tens (or 90) shared in all. Relate 6 to the 6 ones still to be shared.

Discuss the step of sharing 6 ones, emphasizing the use of the multiplication fact $3 \times 2 = 6$. Have a student explain why 2 is written in the ones' place. Relate the addition of 30 and 2 for the quotient, 32, to the 3 tens and 2 ones in each group. Relate the remainder 0 to the fact that there are no more models to share. Have a student read the concluding statement.

Working Together: Ex. 1-3 emphasize place value in two-digit numerals. This is applied in completing the divisions in Ex. 4-6. Use other exercises as needed.

Exercises: If necessary, provide students with models of tens and ones to help obtain quotients or to check their answers.

Assessment

Divide.

1. $2\overline{)26}$ (13)
2. $5\overline{)55}$ (11)
3. $4\overline{)48}$ (12)
4. $3\overline{)39}$ (13)

Pages 254-255

LESSON OUTCOME

Divide a three-digit number by a one-digit number, no regrouping, remainder zero

Materials

models for 9 hundreds, 9 tens, and 9 ones

Prerequisite Skills

Multiply a multiple of ten by a one-digit number, products to 90; multiply a multiple of one hundred by a one-digit number, products to 900; use multiplication to complete basic division facts

Checking Prerequisite Skills

Multiply.

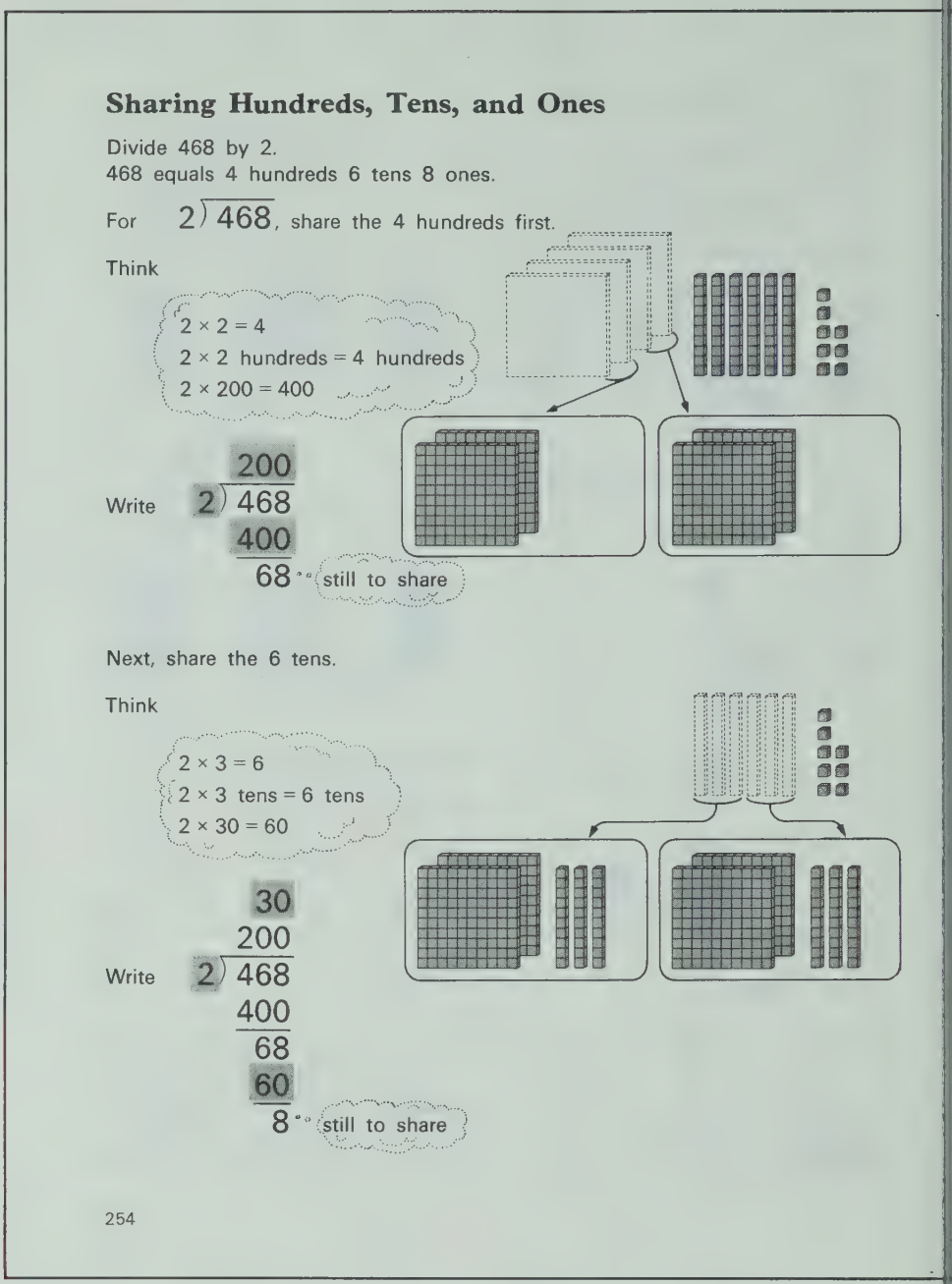
1. 4×10 40 **2.** 3×30 90

3. 2×20 40 **4.** 2×300 600

5. 6×100 600 **6.** 4×200 800

Divide. Write the multiplication fact you use.

7. $3\overline{)9}$ 3 $3 \times 3 = 9$ **8.** $7\overline{)7}$ 1 $7 \times 1 = 7$ **9.** $2\overline{)8}$ 4 $2 \times 4 = 8$



Sharing Hundreds, Tens, and Ones

Divide 468 by 2.
468 equals 4 hundreds 6 tens 8 ones.

For $2\overline{)468}$, share the 4 hundreds first.

Think
$2 \times 2 = 4$
2×2 hundreds $= 4$ hundreds
$2 \times 200 = 400$

Write
$$\begin{array}{r} 200 \\ 2\overline{)468} \\ 400 \\ \hline 68 \end{array}$$
68 still to share

Next, share the 6 tens.

Think
$2 \times 3 = 6$
2×3 tens $= 6$ tens
$2 \times 30 = 60$

Write
$$\begin{array}{r} 30 \\ 200 \\ 2\overline{)468} \\ 400 \\ \hline 68 \\ 60 \\ \hline 8 \end{array}$$
8 still to share

254

LESSON ACTIVITY

Before Using the Pages

- Review on the board the procedures used with $4\overline{)80}$, $3\overline{)69}$, and $2\overline{)68}$, emphasizing the use of multiplication to divide. Write the following division exercises on the board: $2\overline{)242}$, $3\overline{)609}$, and $5\overline{)550}$. Have the students find the quotients by sharing models in the appropriate number of groups. Suggest that a division involving hundreds, tens, and ones can also be completed by using multiplication.

Using the Pages

- The worked example begins on page 254 and continues on page 255. Each step in the division is shown beside the corresponding diagram of sharing models. Guide the students through the solution by asking questions such as,
  "How many equal groups will there be?"
  "How many hundreds, tens, and ones are to be shared?"
  "Which are shared first?"
  "What multiplication fact helps?"
  "How do you find how many are still to be shared?"
  "What is shared after four hundreds?"

  Ensure that the students note how the partial quotie s 200, 30, and 4 have their places lined up as they would in addition, to facilitate finding the quotient 234. Al emphasize the left-to-right order of dividing (hundr s first, then tens, then ones). The division always begins t the largest possible place value.

  You may wish to have the students close their boo think through and write the division steps for $2\overline{)4$ independently, and then check their solutions with worked example. If necessary, demonstrate each step us models.

Working Together: Ex. 1-3 emphasize place value in three-di numerals. Note that 0 in the tens' place (Ex. 6) impl there are no tens to be shared and the procedure of shari moves directly from hundreds to ones. Similarly, in Ex. the division is completed after sharing the tens becau there are 0 ones. You may wish to demonstrate su exercises using the models.

Then, share the 8 ones.

Think $2 \times 4 = 8$

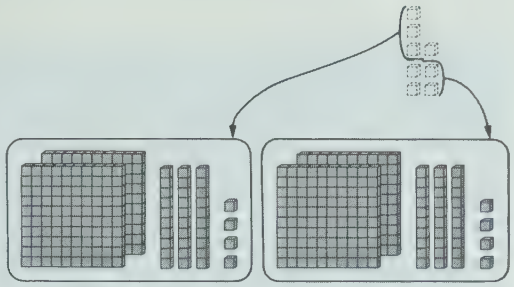
Write

$$\begin{array}{r} 4 \\ 30 \\ 200 \\ 2\overline{)468} \\ 400 \\ \hline 68 \\ 60 \\ \hline 8 \\ 8 \\ \hline 0 \end{array}$$

Add for the quotient.

$$\begin{array}{r} 4 \\ 30 \\ 200 \\ 2\overline{)468} \\ 400 \\ \hline 68 \\ 60 \\ \hline 8 \\ 8 \\ \hline 0 \end{array} \rightarrow 234$$

When 468 is divided by 2, the quotient is 234.



Working Together

How many hundreds? How many tens? How many ones?

1. 862 — 8 hundreds, 6 tens, 2 ones
2. 550 — 5 hundreds, 5 tens, 0 ones
3. 903 — 9 hundreds, 0 tens, 3 ones

Divide.

4. $2\overline{)862}$ → 431
5. $5\overline{)550}$ → 110
6. $3\overline{)903}$ → 301

Exercises

Divide.

1. $3\overline{)639}$ → 213	2. $6\overline{)660}$ → 110	3. $2\overline{)486}$ → 243	4. $4\overline{)408}$ → 102
5. $4\overline{)840}$ → 210	6. $8\overline{)800}$ → 100	7. $3\overline{)360}$ → 120	8. $4\overline{)448}$ → 112
9. $2\overline{)240}$ → 120	10. $5\overline{)505}$ → 101	11. $2\overline{)644}$ → 322	12. $3\overline{)300}$ → 100
13. $3\overline{)936}$ → 312	14. $2\overline{)666}$ → 333	15. $3\overline{)609}$ → 203	16. $4\overline{)884}$ → 221
17. $9\overline{)909}$ → 101	18. $2\overline{)826}$ → 413	19. $4\overline{)488}$ → 122	20. $3\overline{)693}$ → 231

Alistair and Brenda had each earned a penny when Clarissa joined them. The three of them then earned two dimes, one nickel, and two pennies more.

1. How could Alistair, Brenda, and Clarissa share the two dimes, one nickel, and two pennies fairly?

PROBLEM SOLVING

Alistair gets one dime and gives one penny to Clarissa.
Brenda gets one dime and gives one penny to Clarissa.
Clarrisa gets the nickel and the two remaining pennies.

RELATED ACTIVITIES

- Students experiencing difficulty may find it helpful to use models of hundreds, tens, and ones to find a quotient and then show the written solution.
- You may wish to have some students check their divisions by using multiplication.

$$\begin{array}{r} 2 \\ 100 \\ 4\overline{)408} \\ 400 \\ \hline 8 \\ 8 \\ \hline 0 \end{array} \rightarrow 102 \qquad \begin{array}{r} 102 \\ \times \quad 4 \\ \hline 408 \end{array}$$

- Exercises similar to the following may help students relate a basic division fact and its extensions.

$2\overline{)6}$	$2\overline{)60}$	$2\overline{)600}$
$4\overline{)8}$	$4\overline{)80}$	$4\overline{)800}$

- You may wish to have students practice basic division facts by playing the game "Car Park" described on page T 347.

$$\begin{array}{r} 10 \\ 100 \\ 5\overline{)550} \\ 500 \\ \hline 50 \\ 50 \\ \hline 0 \end{array} \rightarrow 110 \qquad \begin{array}{r} 1 \\ 300 \\ 3\overline{)903} \\ 900 \\ \hline 3 \\ 3 \\ \hline 0 \end{array} \rightarrow 301$$

Exercises: Caution the students to space their written work carefully to allow plenty of room to write the partial quotients in each exercise.

Problem Solving: Some students will suggest that the problem can be solved only by exchanging 1 dime for 10 pennies and the other dime for 2 nickels. That way, each student will receive 1 nickel and 4 pennies, (one-third of 27¢). However, the problem can be solved more simply by a process of logical reasoning. If necessary, have the students use real coins and provide plenty of time for them to consider the problem.

Each person should receive one-third of 27¢, or 9¢. However, Alistair and Brenda each earned a penny before Clarissa joined them. Thus, Alistair and Brenda may each take a dime and give their pennies to Clarissa with the remaining nickel and two pennies, for a total of 9¢. This problem could motivate a discussion of the word *fair* in sharing.

Assessment

Divide.

1. $3\overline{)966}$ → 322	2. $2\overline{)448}$ → 224	3. $5\overline{)505}$ → 101	4. $4\overline{)840}$ → 210

Pages 256-257

LESSON OUTCOME

Divide a two-digit number by a one-digit number, regrouping tens as ones, remainder zero

Materials

models for tens and ones

Prerequisite Skills

Find the quotient and the remainder, divisors and quotients to 9; regroup with numbers to 99

Checking Prerequisite Skills

Find the quotient and the remainder.

1. $3\overline{)8}$ 2 R2 **2.** $2\overline{)5}$ 2 R1

3. $6\overline{)9}$ 1 R3 **4.** $5\overline{)9}$ 1 R4

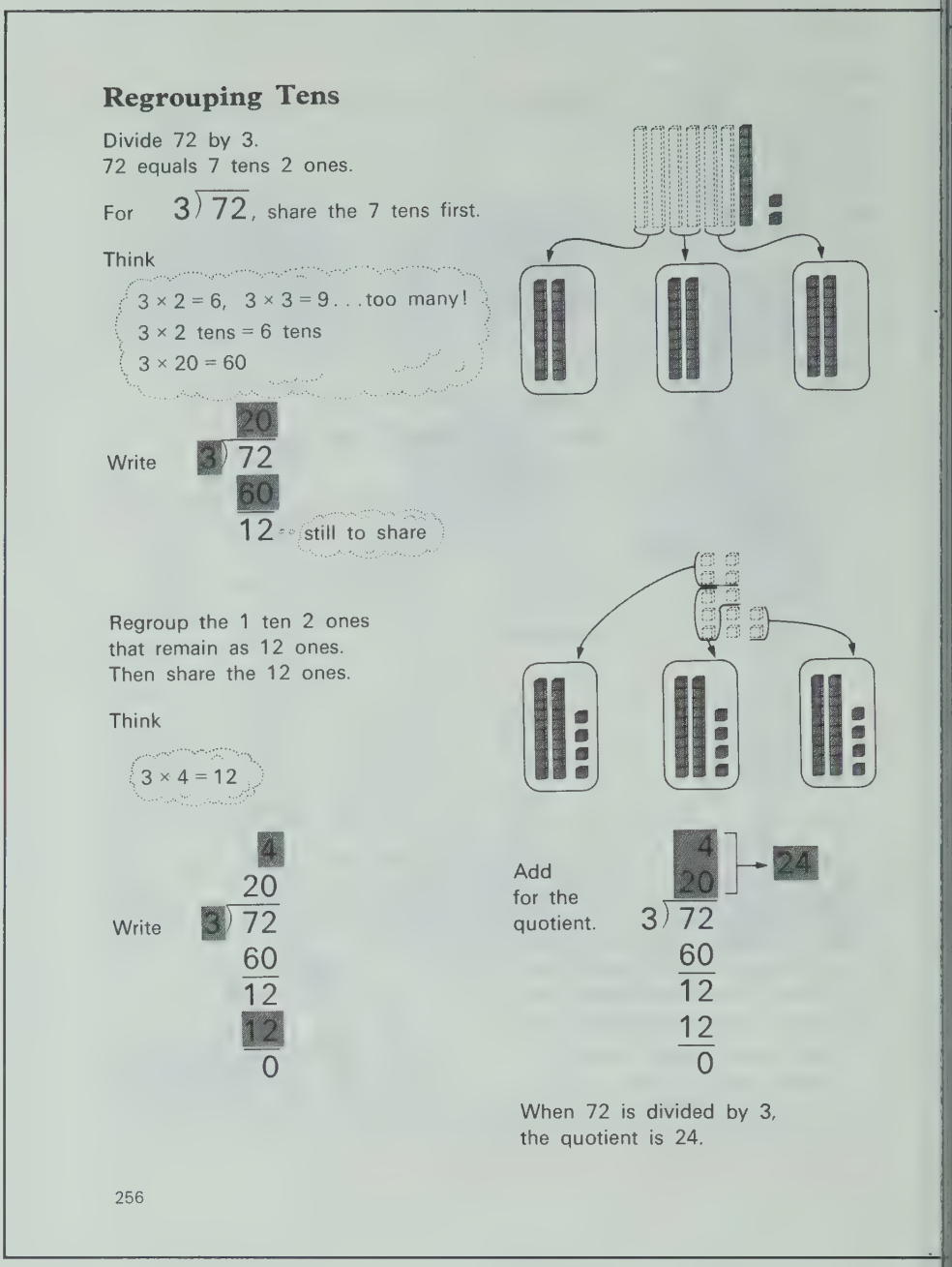
Complete.

5. 24 ones = 2 tens 4 ones

6. 35 ones = 3 tens 5 ones

7. 1 ten 2 ones = 12 ones

8. 3 tens 2 ones = 32 ones



Regrouping Tens

Divide 72 by 3.
72 equals 7 tens 2 ones.

For $3\overline{)72}$, share the 7 tens first.

Think

3 × 2 = 6, 3 × 3 = 9 . . . too many!
3 × 2 tens = 6 tens
3 × 20 = 60

Write
20
3) 72
60
12 still to share

Regroup the 1 ten 2 ones that remain as 12 ones. Then share the 12 ones.

Think

3 × 4 = 12

Write
4
20
3) 72
60
12
12
0

Add for the quotient.
4
20 → 24
3) 72
60
12
12
0

When 72 is divided by 3, the quotient is 24.

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LESSON ACTIVITY

Before Using the Pages

- Have the students find the quotient for $2\overline{)48}$. Have a student complete the division exercise on the board, explaining the steps of the procedure.

  Write the exercise $3\overline{)48}$ on the board. Ask for ways in which this exercise differs from the previous one. Have the students use models to represent 48 and explore ways of sharing 48 among 3 groups. Discuss that there can be only 1 ten in each group and that 1 ten 8 ones are left over. Lead them to suggest that the 1 ten may be regrouped as 10 more ones to continue the sharing process. Have them complete the procedure using models. Then explain that thinking of multiplication can help to obtain the quotient in written form.

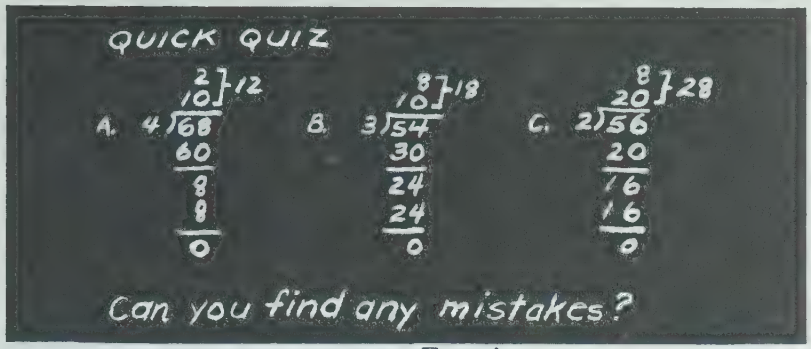
Using the Pages

- The worked example shows the steps in the division along with the corresponding diagrams of models. The red on the numerals helps students to focus on the important aspects of each step and to relate these to the diagrams.

  Question the students as you guide them through the example. Discuss that 3 × 2 = 6 is the best multiplication fact to apply in sharing 7 tens (as opposed to 3 × 1 = and 3 × 3 = 9). Have them note the two diagrams showing 12 still to be shared, the first as 1 ten 2 ones and the second as 12 ones.

  Point out that the division is carried out as usual from left to right. The partial quotients are shown with their places lined up and addition is carried out to find the quotient.

Working Together: Ex. 1-3 deal with the skill of choosing the best multiplication fact to apply in dividing the tens. It might be helpful to review the significance of the word "first" in the instruction. Ex. 4 and 5 involve regrouping tens and ones as ones to facilitate division. For example, for Ex. 4, 15 is 1 ten 5 ones but it is thought of as 15 ones to be shared among 5. For Ex. 6-8, the students are to apply the previous skills in completing the division exercises. Use other similar examples as needed.



Working Together

Give the first multiplication fact you can use to find the quotient.

Example: For $4\overline{)96}$, use $\boxed{4 \times 2 = 8,}$
4×2 tens $= 8$ tens,
or $4 \times 20 = 80$.

1. $3\overline{)78}$ $3\times2=6$
2. $4\overline{)52}$ $4\times1=4$
3. $2\overline{)70}$ $2\times3=6$

Complete.

4. $5\overline{)65}$ → 3, 10 → 13; 50; 15; 15; 0
5. $2\overline{)74}$ → 7, 30 → 37; 60; 14; 14; 0

Divide.

6. $3\overline{)75}$ 25
7. $5\overline{)80}$ 16
8. $2\overline{)94}$ 47

Exercises

The teacher handed out this Quick Quiz.

1. In the quiz, one of the quotients is not correct. Which one? A What is the correct quotient? 17
2. The other quotients are correct, but there still is a mistake in the work. What other division shows a mistake? C Write the division correctly. 8, 20 → 28; $2\overline{)56}$; 40; 16; 16; 0

Divide.

3. $2\overline{)32}$ 16
4. $6\overline{)78}$ 13
5. $3\overline{)81}$ 27
6. $4\overline{)60}$ 15
7. $5\overline{)75}$ 15
8. $2\overline{)54}$ 27
9. $5\overline{)85}$ 17
10. $2\overline{)38}$ 19
11. $4\overline{)92}$ 23
12. $7\overline{)91}$ 13
13. $2\overline{)90}$ 45
14. $3\overline{)84}$ 28
15. $8\overline{)96}$ 12
16. $5\overline{)90}$ 18
17. $2\overline{)78}$ 39
18. $2\overline{)58}$ 29
19. $3\overline{)48}$ 16
20. $5\overline{)70}$ 14
21. $6\overline{)72}$ 12
22. $4\overline{)76}$ 19
23. $3\overline{)57}$ 19

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Exercises: Point out that Ex. 1 and 2 are related to the exercises on the chalkboard illustrated at the top of page 257. Locating the errors and writing correct division exercises help students by requiring them to examine each step of the procedure of dividing with regrouping.

Assessment

Divide.

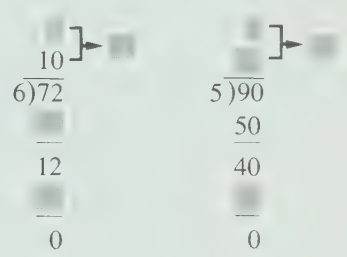
1. $5\overline{)60}$ 12
2. $3\overline{)84}$ 28
3. $7\overline{)84}$ 12
4. $6\overline{)84}$ 14

RELATED ACTIVITIES

- Students experiencing difficulty may find it helpful to use models of tens and ones to find a quotient before writing the division. Also, further practice with simple divisions having remainders greater than zero may be helpful.

$2\overline{)5}$ $6\overline{)25}$ $4\overline{)37}$ $9\overline{)30}$

- Exercises similar to the following may help students with the steps of the written solution in a division.



- Exercises similar to those in the illustration at the top of page 257 may be given. Choose exercises showing mistakes in division from the students' work (without identifying whose work it is).
- For enrichment, students may complete exercises, similar to the following, to observe the change in the quotient as the divisor changes.

$1\overline{)72}$ $2\overline{)72}$ $3\overline{)72}$ $4\overline{)72}$
$6\overline{)72}$ $8\overline{)72}$ $9\overline{)72}$

Depending on the ability of the students, you may wish to include those divisions with remainders greater than zero, in this case, $5\overline{)72}$ and $7\overline{)72}$.

Pages 258-259

OBJECTIVE

Demonstrate competence in division

Materials

tracing paper

Practice

It's Saturday. The boys are holding a backyard carnival for their friends.

1. John sold 9 tickets to Moira for 45¢. How much did each ticket cost? 5¢
2. 4 children each bought the same number of tickets from John. They bought 72 tickets in all. How many tickets did each buy? 18
3. Each ticket costs 5¢. Lisa spent 75¢ for tickets. How many tickets did she buy? 15

The Great All-Seeing Swami challenges you to pick a path, follow it correctly, and find your fortune. Use tracing paper and make no diagonal moves please.

Follow a path showing quotients greater than 15.

Follow a path showing quotients less than 18.

Follow the quotients that are 10 or 20 or a number in between.

20			7			12
4)80			3)21			6)72
33	16	18	13	15	23	17
2)66	6)96	5)90	5)65	6)90	4)92	5)85
11	13	19	20	10	6	20
7)77	3)39	3)57	3)60	8)80	7)42	2)40
9	16	16	9	17	18	16
4)36	2)32	5)80	9)81	2)34	4)72	4)64
17	19	19	18	30	7	13
4)68	5)95	2)38	3)54	3)90	8)56	7)91
11	16	14	19	8	17	21
8)88	3)48	7)98	4)76	6)48	3)51	2)42
15						18
3)45						2)36

YOUR FORTUNE
Today, you will do nothing right!

YOUR FORTUNE
Today, you will do everything right!

Answers will vary

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LESSON ACTIVITY

Using the Pages

- You may wish to select one or two of the division exercises and a word problem to work on the board with the students. This will enable you to review the steps of the algorithm and to remind students that the answer for a problem is written in a sentence.

  For the challenge on page 258, provide each student with a sheet of tracing paper. Have them trace the three paths, using different colors. If necessary, review what is meant by a diagonal move.

  Ex. 6 and 7 are starred as their solutions require more than one step.

You get 3 throws for a ticket in this game.

4. Alexander had 36 throws. How many tickets did he use for this game? 12

5. 4 girls shared 60 throws equally in this game. How many throws did each get? 15

*6. Each ticket costs 5¢. How many throws do you get for 65¢ worth of tickets? 39

*7. Each ticket costs 5¢. Sean and Dawn spent 40¢ worth of tickets in this game. Each took the same number of throws. How many throws did each take? 12

Divide.

8. $2\overline{)76}$ 38	9. $6\overline{)42}$ 7	10. $4\overline{)56}$ 14	11. $3\overline{)63}$ 21	12. $7\overline{)84}$ 12	13. $4\overline{)40}$ 10
14. $5\overline{)55}$ 11	15. $9\overline{)72}$ 8	16. $2\overline{)96}$ 48	17. $4\overline{)52}$ 13	18. $3\overline{)69}$ 23	19. $6\overline{)84}$ 14
20. $3\overline{)42}$ 14	21. $5\overline{)50}$ 10	22. $4\overline{)48}$ 12	23. $5\overline{)70}$ 14	24. $2\overline{)86}$ 43	25. $4\overline{)24}$ 6
26. $8\overline{)96}$ 12	27. $4\overline{)88}$ 22	28. $2\overline{)80}$ 40	29. $9\overline{)99}$ 11	30. $3\overline{)72}$ 24	31. $2\overline{)70}$ 35
32. $3\overline{)36}$ 12	33. $4\overline{)84}$ 21	34. $3\overline{)96}$ 32	35. $2\overline{)58}$ 29	36. $6\overline{)54}$ 9	37. $3\overline{)87}$ 29
38. $4\overline{)96}$ 24	39. $2\overline{)98}$ 49	40. $8\overline{)72}$ 9	41. $3\overline{)81}$ 27	42. $2\overline{)82}$ 41	43. $3\overline{)75}$ 25
44. $9\overline{)90}$ 10	45. $3\overline{)78}$ 26	46. $2\overline{)54}$ 27	47. $5\overline{)60}$ 12	48. $3\overline{)84}$ 28	49. $2\overline{)92}$ 46

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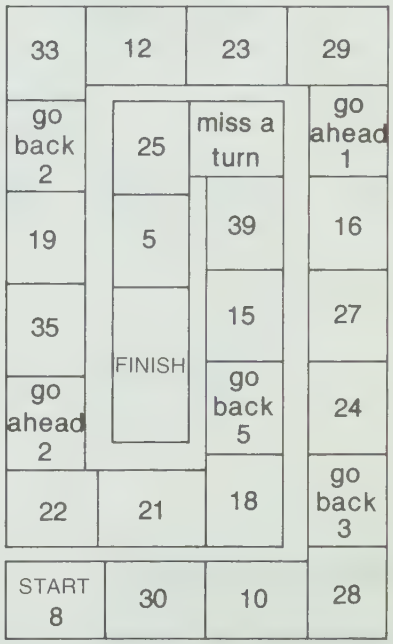
RELATED ACTIVITIES

- If students found a path for just one starting point for the challenge on page 258, you may wish to have them find paths for the other two starting points.
- To practice division with remainders greater than zero, two or three students may play the game "Remainder Race" using a game board similar to the one shown, a marker for each player, and a die marked 4, 5, 6, 7, 8, 9. Markers are placed at "Start". Each player, in turn, rolls the die, finds the remainder when 8 is divided by the number shown on the die, and advances her/his marker that number of spaces. For example, if the die shows 6, the remainder for $6\overline{)8}$ is 2, and the player advances her/his marker to "10". In the next round, this player would divide 10 by the number shown on the die. The first player to reach "Finish" is the winner.



Pages 260-261

LESSON OUTCOME

Divide a three-digit number by a one-digit number, regrouping tens as ones, remainder zero

Materials

models for hundreds, tens, and ones

Prerequisite Skills

Find the quotient and the remainder, divisors and quotients to 9; regroup with numbers to 99

Checking Prerequisite Skills

Find the quotient and the remainder.

1. $4\overline{)6}$ 1 R2 **2.** $3\overline{)4}$ 1 R1 **3.** $2\overline{)9}$ 4 R1

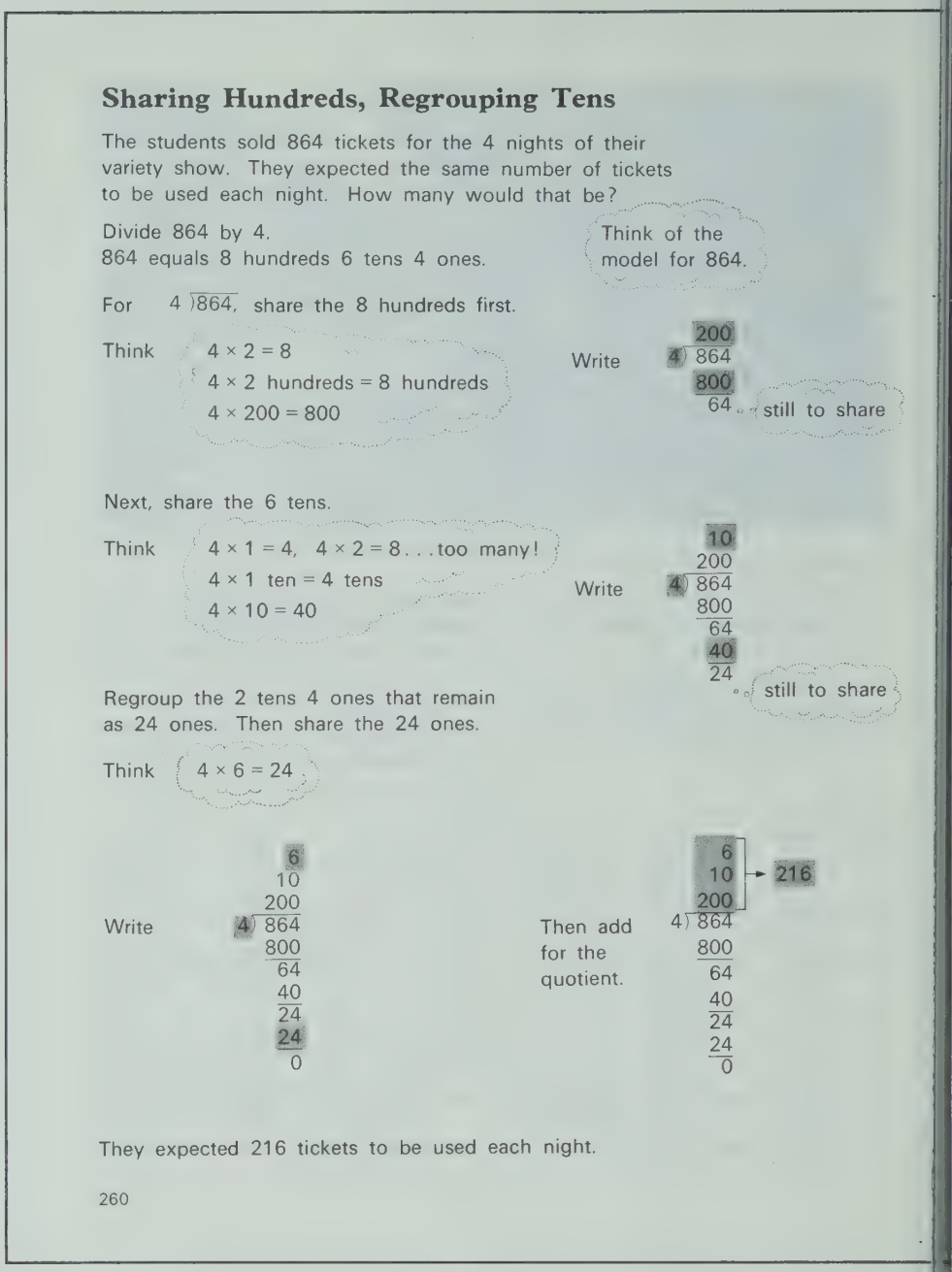
Complete.

4. 16 ones = 1 ten 6 ones

5. 35 ones = 3 tens 5 ones

6. 3 tens 2 ones = 32 ones

7. 2 tens 7 ones = 27 ones



Sharing Hundreds, Regrouping Tens

The students sold 864 tickets for the 4 nights of their variety show. They expected the same number of tickets to be used each night. How many would that be?

Divide 864 by 4.
864 equals 8 hundreds 6 tens 4 ones.

Think of the model for 864.

For $4\overline{)864}$, share the 8 hundreds first.

Think
4 × 2 = 8
4 × 2 hundreds = 8 hundreds
4 × 200 = 800

Write
200
4) 864
800
64
still to share

Next, share the 6 tens.

Think
4 × 1 = 4, 4 × 2 = 8 . . . too many!
4 × 1 ten = 4 tens
4 × 10 = 40

Write
10
200
4) 864
800
64
40
24
still to share

Regroup the 2 tens 4 ones that remain as 24 ones. Then share the 24 ones.

Think
4 × 6 = 24

Write
6
10
200
4) 864
800
64
40
24
24
0

Then add for the quotient.
6
10 → 216
200
4) 864
800
64
40
24
24
0

They expected 216 tickets to be used each night.

260

LESSON ACTIVITY

Before Using the Pages

- Have the students find the quotient for $4\overline{)64}$. Review the need to regroup 2 tens 4 ones as 24 ones to complete the division. Write the exercise $4\overline{)864}$ on the board and ask how it differs from the previous exercise. Ask what would be shared first. Then suggest that thinking of multiplication can help to complete the division in written form.

Using the Pages

- The worked example relates each step of the division to the sharing concept, but emphasizes the use of multiplication to divide. Read the problem and discuss that division can be used to find the number in each of equal groups.

  Question the students as you guide them through the steps of the solution. If necessary, use models to represent 864 and demonstrate the procedure. Emphasize that thinking of basic multiplication facts is helpful in carrying out the division in written form. Have a student read the concluding statement at the bottom of page 260.

  You may wish to have the students work the division exercise $4\overline{)864}$ independently and then check their work with the example on page 260.

Exercises: Remind the students to space their exercises to allow plenty of room for writing the quotients. Also, they should take care in stacking the partial quotients so that the places are aligned correctly.

Keeping Sharp: These exercises help to maintain skills in addition and subtraction, with and without regrouping. If you do not wish to assign all the exercises at this time, you may choose to assign one column of the exercises to Ex. 18 and perhaps odd-numbered exercises after Ex. 18. Note that Ex. 19 can provide an opportunity to review the order (commutative) property of addition. It may be interesting to note how many students do not perform the additions to answer Ex. 19.

Exercises

Divide.

1. $2\overline{)436}$ 218	2. $3\overline{)975}$ 325	3. $4\overline{)868}$ 217
4. $3\overline{)615}$ 205	5. $5\overline{)585}$ 117	6. $2\overline{)612}$ 306
7. $3\overline{)342}$ 114	8. $2\overline{)694}$ 347	9. $3\overline{)924}$ 308
10. $2\overline{)876}$ 438	11. $7\overline{)749}$ 107	12. $2\overline{)452}$ 226
13. $3\overline{)687}$ 229	14. $4\overline{)432}$ 108	15. $2\overline{)870}$ 435

Solve.

16. 216 chairs were set up in 2 sections for the variety show. The same number of chairs were in each section. How many chairs were in each section? 108

17. The Activities Fund made $496 from the 4 shows. If the shows earned equal amounts, how much did the Fund make each night? $124

Subtract.

1. 767 − 632 = 135	2. 6984 − 4030 = 2954	3. $1738 − 314 = $1424
4. 386 − 248 = 138	5. 1364 − 723 = 641	6. $429 − 352 = $ 77
7. 8254 − 5825 = 2429	8. 630 − 333 = 297	9. $2606 − 1971 = $ 635
10. 5914 − 1946 = 3968	11. 6622 − 2769 = 3853	12. $3126 − 177 = $2949
13. 3000 − 965 = 2035	14. 900 − 558 = 342	15. $3003 − 1178 = $1825
16. 303 − 286 = 17	17. 6035 − 4348 = 1687	18. $4306 − 649 = $3657

Use >, <, or = to make true statements.

19. 328 + 823 ◯ 823 + 328 =
20. 963 − 369 ◯ 936 − 396 >
21. 234 + 567 ◯ 987 − 123 <
22. 1402 − 899 ◯ 402 + 128 <
23. $309 + $949 ◯ $1567 − $309 =
24. 3206 − 1957 ◯ 2206 − 957 =
25. 1338 − 446 ◯ 446 + 446 =
26. 2468 + 1357 ◯ 1234 + 5678 <
27. 555 + 777 ◯ 2222 − 999 >
28. $1000 − $333 ◯ $333 + $333 >
29. 6314 − 3641 ◯ 4136 − 1364 <
30. 4638 + 2785 ◯ 2688 + 4735 <
31. 2222 − 888 ◯ 666 + 666 >
32. 978 + 896 ◯ 1875 <

KEEPING SHARP

Ex. 1-18 present subtraction skills as follows:
Ex. 1-3 — no regrouping
Ex. 4-6 — one regrouping
Ex. 7-9 — two regroupings
Ex. 10-12 — three regroupings
Ex. 13-18 — three regroupings with zeros in the minuend
Column 3 — amounts of money

ssessment

ivide.

1. $3\overline{)645}$ 215
2. $2\overline{)478}$ 239
3. $4\overline{)864}$ 216
4. $8\overline{)832}$ 104

RELATED ACTIVITIES

- Some students may need more experience in sharing models to help understand the steps of the division: share the hundreds; share as many tens as possible; regroup the remaining tens and ones as ones; share the ones.
- Some students may benefit from practice in regrouping tens and ones as ones. If necessary, they may use models or draw diagrams to help obtain the answers for exercises similar to the following.

25 2 tens 5 ones = 25 ones

17 1 ten 7 ones = _____ ones

42 4 tens _____ ones = _____ ones

21 _____ tens _____ one = _____ ones

36 _____ tens _____ ones = _____ ones

- Expanded notation can be used in division.

$4\overline{)844}$

$$\begin{array}{r} 200 + 10 + 1 \\ 4\overline{)800 + 40 + 4} \\ \underline{800 \quad 40 \quad 4} \\ 0 \quad 0 \quad 0 \end{array}$$

$4\overline{)844}$ 211

$4\overline{)864}$

$$\begin{array}{r} 200 + 10 + 6 \\ 4\overline{)800 + 60 + 4} \\ \underline{800 \quad 40} \\ 0 \quad 20 + 4 \\ \quad\quad 24 \\ \quad\quad \underline{24} \\ \quad\quad 0 \end{array}$$

or

$$\begin{array}{r} \quad\quad\quad\quad 5 \\ 200 + 10 + 1 \\ 4\overline{)800 + 60 + 4} \\ \underline{800 \quad 40 \quad 4} \\ 0 \quad 20 \quad 0 \\ \quad\quad \underline{20} \\ \quad\quad 0 \end{array}$$

$4\overline{)864}$ 216

Have more capable students try this method for Ex. 1-15.

Pages 262-263

LESSON OUTCOME

Divide a three-digit number by a one-digit number, regrouping hundreds as tens, quotients to 99, remainder zero

Materials

models for hundreds, tens, and ones

Prerequisite Skills

Use multiplication to complete basic division facts; multiply a multiple of ten by a one-digit number

Checking Prerequisite Skills

Divide. Write the multiplication fact you use.

1. $3\overline{)27}$ (9) $3 \times 9 = 27$

2. $8\overline{)24}$ (3) $8 \times 3 = 24$

3. $6\overline{)54}$ (9) $6 \times 9 = 54$

Multiply.

4. $90 \times 3 = 270$

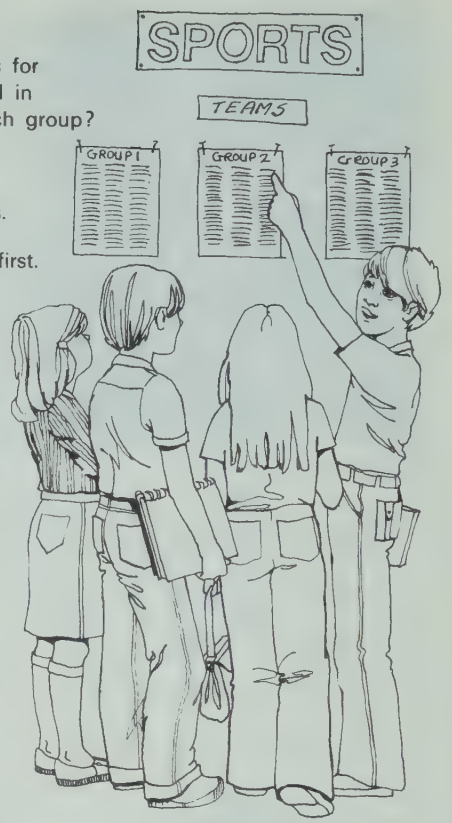
5. $30 \times 8 = 240$

6. $80 \times 4 = 320$

7. $70 \times 6 = 420$

Regrouping Hundreds

276 children were placed in 3 groups for school sports. The groups were equal in size. How many children were in each group?



Divide 276 by 3.
Think of the model for 276.
276 equals 2 hundreds 7 tens 6 ones.

For $3\overline{)276}$, share the 2 hundreds first.

How can we share 2 hundreds among 3?

The easiest way to share 2 hundreds is by regrouping 2 hundreds 7 tens as 27 tens. Then share the 27 tens.

Think
$3 \times 9 = 27$
3×9 tens $= 27$ tens
$3 \times 90 = 270$

Write
$$\begin{array}{r} 90 \\ 3\overline{)276} \\ 270 \\ \hline 6 \end{array}$$
still to share

Next, share the 6 ones.

Think $3 \times 2 = 6$

Write
$$\begin{array}{r} 2 \\ 90 \\ 3\overline{)276} \\ 270 \\ \hline 6 \\ 6 \\ \hline 0 \end{array}$$

Then add for the quotient.
$$\begin{array}{r} 2 \\ 90 \\ 3\overline{)276} \\ 270 \\ \hline 6 \\ 6 \\ \hline 0 \end{array} \rightarrow 92$$

Each group had 92 children.

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LESSON ACTIVITY

Before Using the Pages

- Write a few division exercises on the board, such as $3\overline{)210}$, $2\overline{)106}$, and $4\overline{)124}$. Have the students use models to find the quotients. Remind them that hundreds are shared first, then tens, then ones. Question them about the procedure they used. Discuss that in each case there were not enough hundreds so that each group could receive at least 1 hundred. Summarize that the hundreds in each exercise had to be regrouped as tens. Have students name the number of tens shared in each exercise.

Using the Pages

- Read the problem to introduce the situation and discuss why division may be used to solve it. Question the students as you guide them through the solution. If necessary, use models to represent 276 as 2 hundreds 7 tens 6 ones and then as 27 tens 6 ones. Emphasize that thinking of the basic fact $3 \times 9 = 27$ helps to derive the fact 3×9 tens $= 27$ tens, or $3 \times 90 = 270$. Point out that the digits of the partial quotients 90 and 2 have their places lined up correctly with the digits of the dividend 276. In summary, review that for $3\overline{)276}$, there are not enough hundreds for each of 3 groups to have at least 1 hundred. Thus 2 hundreds 7 tens are regrouped as 27 tens.

Working Together: Ex. 1-4 deal with the skill of regrouping hundreds as tens in three-digit numerals. It may be necessary for some students to use models to help understand that 248, for example, is named by 2 hundreds 4 tens 8 ones, and also by 24 tens 8 ones. Use other similar exercises as needed, including numerals for which there are 0 tens or 0 ones, as in Ex. 3 and 4. The skill of regrouping is applied in interpreting the divisions in Ex. 5 and 6. For Ex. 7-10, the students are to carry out the divisions independently.

Working Together

Complete.

1. 248 equals 2 hundreds 4 tens 8 ones or 24 tens 8 ones.
2. 159 equals 1 hundred 5 tens 9 ones or 15 tens 9 ones.
3. 320 equals 3 hundreds 2 tens or 32 tens.
4. 405 equals 4 hundreds 5 ones or 40 tens 5 ones.
5. For $8\overline{)248}$, share 24 tens first.
6. For $3\overline{)159}$, share 15 tens first.

Divide.

7. $8\overline{)248}$ → 31
8. $3\overline{)159}$ → 53
9. $4\overline{)320}$ → 80
10. $5\overline{)405}$ → 81

Exercises

Divide.

1. $3\overline{)189}$ → 63
2. $5\overline{)155}$ → 31
3. $4\overline{)160}$ → 40
4. $2\overline{)148}$ → 74
5. $9\overline{)540}$ → 60
6. $4\overline{)208}$ → 52
7. $7\overline{)497}$ → 71
8. $6\overline{)420}$ → 70
9. $3\overline{)273}$ → 91
10. $5\overline{)100}$ → 20
11. $8\overline{)560}$ → 70
12. $6\overline{)546}$ → 91

Which of these are Magic Squares?

13.

$2\overline{)162}$ → 81	$9\overline{)99}$ → 11	$4\overline{)244}$ → 61
$7\overline{)217}$ → 31	$5\overline{)255}$ → 51	$3\overline{)213}$ → 71
$6\overline{)246}$ → 41	$1\overline{)91}$ → 91	$8\overline{)168}$ → 21

yes

14.

$4\overline{)248}$ → 62	$5\overline{)205}$ → 41	$6\overline{)486}$ → 81
$9\overline{)729}$ → 81	$7\overline{)427}$ → 61	$3\overline{)126}$ → 42
$9\overline{)369}$ → 41	$3\overline{)246}$ → 82	$8\overline{)488}$ → 61

yes

15.

$5\overline{)305}$ → 61	$9\overline{)639}$ → 71	$3\overline{)39}$ → 13	$4\overline{)432}$ → 108
$6\overline{)642}$ → 107	$2\overline{)46}$ → 23	$4\overline{)288}$ → 72	$8\overline{)408}$ → 51
$2\overline{)126}$ → 63	$7\overline{)357}$ → 51	$8\overline{)856}$ → 107	$4\overline{)128}$ → 32
$4\overline{)88}$ → 22	$7\overline{)756}$ → 108	$6\overline{)366}$ → 61	$3\overline{)186}$ → 62

yes

In a Magic Square, the *sums* for the rows, columns, and diagonals are all the same.

263

Exercises: Ex. 1-12 involve the kind of division introduced in this lesson. In Ex. 13-15, the students will encounter the other kinds of division studied in previous lessons as well. Point out the sentence in the "thought cloud" at the bottom of page 263. Discuss that after the quotients are found, the sums of the quotients for each row, column, and diagonal will reveal if a square is "magic".

Assessment

Divide.

1. $6\overline{)126}$ → 21
2. $3\overline{)249}$ → 83
3. $5\overline{)450}$ → 90
4. $8\overline{)408}$ → 51

RELATED ACTIVITIES

- Some students may need further practice in regrouping hundreds and tens as tens. If necessary, students may use models or draw diagrams to help obtain answers. Use exercises similar to Ex. 1-4 of *Working Together*.
- Some students may benefit from completing groups of exercises similar to the following.

$3\overline{)24}$	$3\overline{)240}$	$3\overline{)249}$
$7\overline{)42}$	$7\overline{)420}$	$7\overline{)427}$

Pages 264-265

LESSON OUTCOME

Divide a three-digit number by a one-digit number with two regroupings, remainders

Materials

models for hundreds, tens, and ones

Prerequisite Skills

Find the quotient and the remainder, quotients and divisors to 9; regroup with numbers to 999

Checking Prerequisite Skills

Find the quotient and the remainder.

1. $3\overline{)7}$ 2 R1
2. $8\overline{)53}$ 6 R5
3. $9\overline{)40}$ 4 R4
4. $6\overline{)44}$ 7 R2
5. $7\overline{)32}$ 4 R4
6. $5\overline{)24}$ 4 R4

Complete.

7. 146 = 1 hundred 4 tens 6 ones
   or 14 tens 6 ones
8. 148 = 1 hundred 8 tens 8 ones
   or 14 tens 8 ones
9. 118 = 1 hundred 1 ten 8 ones
   or 11 tens 8 ones
10. 605 = 6 hundreds 0 tens 5 ones
    or 60 tens 5 ones

Regrouping Hundreds, Regrouping Tens

746 books are to be shared equally among 3 classrooms. How many books will each classroom get?

Divide 746 by 3.
Think of the model for 746.
746 equals 7 hundreds 4 tens 6 ones.

For $3\overline{)746}$, share the 7 hundreds first.

Think: 3 × 2 = 6, 3 × 3 = 9 . . . too many!
3 × 2 hundreds = 6 hundreds
3 × 200 = 600

Write:
200
3) 746
600
146 still to share

Regroup the 1 hundred 4 tens that remain as 14 tens. Then share the 14 tens.

Think: 3 × 4 = 12, 3 × 5 = 15 . . . too many!
3 × 4 tens = 12 tens
3 × 40 = 120

Write:
40
200
3) 746
600
146
120
26 still to share

Regroup the 2 tens 6 ones that remain as 26 ones. Then share the 26 ones.

Think: 3 × 8 = 24, 3 × 9 = 27 . . . too many!

Write:
8
40
200
3) 746
600
146
120
26
24
2 remainder

Then add. Write the remainder beside the quotient when the remainder is not 0.

8
40
200 → 248 R2
3) 746
600
146
120
26
24
2

Each classroom will get 248 books.
There will be 2 books left over.

264

LESSON ACTIVITY

Before Using the Pages

- Write a few division exercises on the board, similar to $3\overline{)435}$ and $2\overline{)573}$. Have the students use models to find the quotients. Remind them that hundreds are to be shared first, then tens, then ones. Have a few students describe the procedure used, emphasizing the necessary regroupings. For example, for $3\overline{)435}$, there is 1 hundred left when the hundreds are shared and it is regrouped as 10 more tens. There is 1 ten left when the 13 tens are shared and it is regrouped as 10 more ones. The 15 ones are shared and the remainder is 0. For $2\overline{)573}$, the remainder is 1.

Using the Pages

- The worked example relates the steps of the division $3\overline{)746}$ to the sharing concept, but emphasizes the use of multiplication to divide. The red on the numerals helps students to focus on each stage of the division. Lead the students through the solution by asking questions such as,

"How many hundreds, tens, and ones are there for sev hundred forty-six?"
"What is shared first?"
"What multiplication fact is helpful?"
"How do you find how many are still to be shared?"
"What is shared after the hundreds?"
"How many tens are the same as 1 hundred 4 tens?"

You may wish to demonstrate the division $3\overline{)746}$, usi models at the same time as each step of the worked examp is discussed. Note that the division gives a remainder of Point out how this is described in the concludi statements.

Working Together: The skill of using the most appropria multiplication fact to begin a division is dealt with in E 1-3. Note that in Ex. 2, there are not enough hundreds share so that each of 7 groups can receive at least 1 hundr $(7\overline{)483})$. The division begins with sharing 48 te $(7 \times 6 = 42,\ 7 \times 7 = 49$ . . . too many! $7 \times$ tens = 42 tens, $7 \times 60 = 420)$. Use other similar exa ples as needed, and demonstrate the procedure with mode

Working Together

Give the first multiplication fact that can be used to find the quotient.

Example: For $2\overline{)734}$, use $\boxed{2 \times 3 = 6,}$
2×3 hundreds $= 6$ hundreds, or $2 \times 300 = 600$

1. $4\overline{)948}$ $4 \times 2 = 8$ **2.** $7\overline{)483}$ $7 \times 6 = 42$ **3.** $3\overline{)806}$ $3 \times 2 = 6$

Complete.

7
30
200
4. $4\overline{)948}$
$800 \leftarrow 4 \times 200$
148
$120 \leftarrow 4 \times 30$
28
$28 \leftarrow 4 \times 7$
0

Divide. Write the remainder beside the quotient when the remainder is not 0.

5. $2\overline{)718}$ 359
6. $7\overline{)483}$ 69
7. $3\overline{)806}$ 268 R2
8. $6\overline{)230}$ 38 R2

Exercises

Divide.

1. $3\overline{)876}$ 292	**2.** $6\overline{)834}$ 139	**3.** $5\overline{)920}$ 184	**4.** $2\overline{)672}$ 336	**5.** $7\overline{)329}$ 47	**6.** $4\overline{)763}$ 190 R3
7. $6\overline{)792}$ 132	**8.** $2\overline{)471}$ 235 R1	**9.** $3\overline{)711}$ 237	**10.** $5\overline{)240}$ 48	**11.** $4\overline{)776}$ 194	**12.** $6\overline{)533}$ 88 R5
13. $9\overline{)404}$ 44 R8	**14.** $7\overline{)605}$ 86 R3	**15.** $8\overline{)992}$ 124	**16.** $4\overline{)504}$ 126	**17.** $8\overline{)535}$ 66 R7	**18.** $7\overline{)994}$ 142

When the remainder is 0, you can use multiplication to check your division.

1. Use multiplication to check your division in Exercises 1–3 above.

Example: For $3\overline{)744}$, multiply 3 and 248 to check.

248
248
$\times \quad 3$
$\overline{\quad ? \quad}$

If the product is not 744, there is a mistake in your work.

try this

Ex. 4 focuses on the multiplications used at each stage of the division and helps students to think through the procedure. Ex. 5-8 require the students to complete the divisions independently. Ensure that the partial quotients are written with their places lined up with those of the dividend. Have students show their solutions on the board and explain the procedure used.

xercises: You may wish to remind the students to space their exercises so that plenty of room is allowed for the quotients. Also, remind them to show the remainder beside the quotient when the remainder is greater than zero.

ry This: The use of multiplication to check division is presented in this feature for division exercises with 0 as the remainder. Have the students complete the example provided and then apply that procedure to check Ex. 1-3.

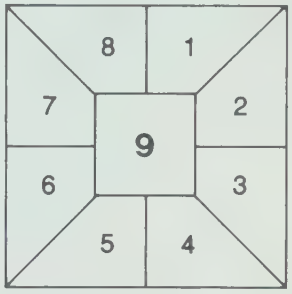
ssessment

ivide.

1. $2\overline{)562}$ 281 **2.** $5\overline{)840}$ 168 **3.** $3\overline{)613}$ 204 R1 **4.** $9\overline{)372}$ 41 R3

RELATED ACTIVITIES

- Some students may need more experience in sharing models to find quotients. Have them use models to find quotients for exercises on page 265. They may write the division after each quotient is found by sharing models.
- Some students may need to practice basic division facts. Have them play the game "Lucky Nine" using a game board as shown below, a set of cards showing basic division facts, and nine markers for each of 3 or 4 players.



The cards are placed in a stack face down. The first player turns the top card face up, for example, $24 \div 4$, and places a marker on the space for the quotient, 6. If there is a marker on the space for 6 already, the player removes it and places it in her/his pile of markers, instead of placing a marker on the game board. A player who obtains a division fact card for 9 claims all the markers on the game board. The game ends when one player has no more markers. The winner is the player with the most markers.

Pages 266-267

LESSON OUTCOME

Use division to find an average

Vocabulary

average

Prerequisite Skills

Divide, dividends to 999, divisors to 9

Checking Prerequisite Skills

Divide.

1. $5\overline{)125}$ 25
2. $3\overline{)78}$ 26
3. $6\overline{)618}$ 103
4. $4\overline{)932}$ 233

Finding an Average

$822 was spent on 6 field trips.
What was the **average cost** of each trip?

Divide $822 by 6.

$$6\overline{)\$822}\quad \begin{array}{r} 7 \\ 30 \\ 100 \end{array} \rightarrow \$137$$

$$\begin{array}{r} 600 \\ \hline 222 \\ 180 \\ \hline 42 \\ 42 \\ \hline 0 \end{array}$$

If an amount is thought of as being shared equally, the result is an **average amount**.

The average cost of each field trip was $137.

Exercises

Divide to find an average for each of these.

1. 132 students went on the 6 field trips. 22
2. 150 tags were placed in 6 envelopes. 25
3. The school spent $375 on 5 movie films. $75
4. John paid 92¢ for 4 pencils. 23¢
5. Candy earned $56 in 8 weeks on her paper route. $7
6. 259 children rode on 7 buses. 37
7. 980 cartons of milk were drunk in 5 school days. 196
8. Sharon had one week to collect 35 insects. 5
*9. There were 700 beads in 3 bags. about 233
*10. The 8 clubs had 318 members. about 40

Divide.

11. $4\overline{)780}$ 195
12. $3\overline{)\$801}$ $267
13. $9\overline{)891}$ 99
14. $5\overline{)530}$ 106
15. $8\overline{)\$608}$ $ 76
16. $7\overline{)336}$ 48
17. $6\overline{)760}$ 126 R4
18. $5\overline{)486}$ 97 R1
19. $9\overline{)700}$ 77 R7
20. $3\overline{)710}$ 236 R2
21. $8\overline{)805}$ 100 R5
22. $7\overline{)622}$ 88 R6

*23. Multiply the quotient by the divisor in each of the Exercises 11–16. The product should equal the number that was divided. If they are not equal, there is a mistake in your work.

*24. Multiply the quotient by the divisor in Exercise 17. Then add the remainder to the product. Your result should equal the number that was divided. If not, there is a mistake in your work.

266

LESSON ACTIVITY

Using the Pages

- Have a student read the title at the top of page 266. Ask whether any of the students have heard the term *average* before this time. If possible, have a few students tell the meaning of the term in their own words or give examples to show the meaning. Then present the problem of the worked example and the explanation of the term *average amount*. Emphasize that for 6 field trips the average cost of one trip is found by assuming that each trip cost the same amount. Review the steps of the division procedure for the exercise $6\overline{)\$822}$. You may wish to have the students use multiplication to check the division.

Exercises: For Ex. 1-8, the divisions give a remainder of 0. Ex. 9 and 10 are starred since their remainders are greater than 0. These can motivate a discussion as to which of two possible answers may be better. For Ex. 9, 2 bags would contain 233 beads and the third bag would contain 234 beads. Thus, perhaps 233 is the better answer for the average. Similarly, for Ex. 10, 6 of the clubs could have 4 members and the other 2 clubs would have 39 member Thus, 40 may be a better answer for the average.

The use of multiplication to check division is present in Ex. 23 for divisions with a remainder of 0, and in Ex. for divisions with remainders greater than 0. After t students check Ex. 17, you may wish to have them che Ex. 18-22. Remind the students to show the symbol $ wi the quotients in the appropriate exercises.

Keeping Sharp: These exercises help to maintain skills addition and subtraction with decimals. You may wish indicate the format to be followed in writing Ex. 25-2 Each should show two exercises followed by a stateme showing the correct relation symbol. For Ex. 25, f example,

$$\begin{array}{r} 3.7 \\ +\ 3.9 \\ \hline 7.6 \end{array} \qquad \begin{array}{r} 15.1 \\ -\ 7.6 \\ \hline 7.5 \end{array}$$

$$3.7 + 3.9 > 15.1 - 7.6$$

Add.

1. 2.2 + 6.2 = 8.4	**2.** 3.03 + 1.62 = 4.65	**3.** \$2.81 + 1.74 = \$4.55	**4.** 13.9 + 5.7 = 19.6	**5.** 6.4 + 8.8 = 15.2	**6.** 22.56 + 4.76 = 27.32
7. \$3.69 + 8.54 = \$12.23	**8.** 58.7 + 23.5 = 82.2	**9.** 19.55 + 25.89 = 45.44	**10.** \$2.80 + 9.81 = \$12.61	**11.** 0.7 + 7.3 = 8.0	**12.** 6.14 + 7.59 = 13.73

Subtract.

13. 7.67 − 3.42 = 4.25	**14.** 8.9 − 0.4 = 8.5	**15.** \$8.04 − 4.21 = \$3.83	**16.** 56.4 − 4.8 = 51.6	**17.** 52.49 − 44.72 = 7.77	**18.** \$8.00 − 1.55 = \$6.45
19. 7.3 − 3.7 = 3.6	**20.** 30.80 − 3.96 = 26.84	**21.** 64.2 − 28.9 = 35.3	**22.** \$9.05 − 4.26 = \$4.79	**23.** 70.00 − 61.98 = 8.02	**24.** 4.1 − 0.5 = 3.6

Use >, <, or = to make true statements.

25. 3.7 + 3.9 ◍ 15.1 − 7.6 >

26. 10.00 − 6.38 ◍ 9.99 − 6.37 =

27. \$6.68 + \$5.98 ◍ \$10.00 + \$2.76 <

28. \$2.60 − \$1.84 ◍ \$0.09 + \$0.58 >

KEEPING SHARP

267

RELATED ACTIVITIES

- For further practice, have students complete the following division number wheel. (You may wish to use copies of page T 360.)

- Provide students with information relevant to the school environment and have them find an average for each. Some suggestions are given below.

248 children
are in 8 classes.

276 books
are on 6 shelves.

132 children ride
home in 3 buses.

Assessment

Divide to find an average for each of these.

1. Ann paid 95¢ for 5 pens. 19¢
2. John completed 26 exercises in 2 min. 13
3. 128 children rode on 4 buses. 32

Pages 268-269

LESSON OUTCOME

Use a shorter form for division

Prerequisite Skills

Divide by a one-digit number, dividends to 999

Checking Prerequisite Skills

Divide.

1. 3)396 — 132
2. 5)155 — 31
3. 4)920 — 230
4. 7)823 — 117 R4

A Shorter Form for Division

Some students discovered a shorter form for dividing.

Divide 514 by 8.
514 equals 5 hundreds 1 ten 4 ones.

For $8\overline{)514}$, the easiest way to share 5 hundreds is by regrouping 5 hundreds 1 ten as 51 tens. Then share the 51 tens.

Think: 8 × 6 = 48; 8 × 6 tens = 48 tens; 8 × 60 = 480

Write:

Longer Form

```
  60
8)514
 480
  34
```

or Shorter Form

```
   6
8)514
 480
  34
```

Regroup the 3 tens 4 ones that remain as 34 ones. Then share the 34 ones.

Think: 8 × 4 = 32

Write:

```
   4
  60
8)514
 480
  34
  32
   2
```

or

```
 64 R2
8)514
 480
  34
  32
   2
```

Then add and write the remainder to finish the longer form.

```
  4
 60 ]→ 64 R2
8)514
 480
  34
  32
   2
```

Write the remainder here and the work is done!

When 514 is divided by 8, the quotient is 64 and the remainder is 2.

268

LESSON ACTIVITY

Using the Pages

- The worked example presents two forms for showing the division $8\overline{)514}$. Read the sentence at the top of page 268. Then have the students observe the two forms shown in the first division step. Have them tell in their own words how they differ. Similarly, have them contrast the remaining steps for each form. Emphasize that the shorter form involves less written work in the quotient, but the rest of the division format is the same. The shorter form shows the quotient (64, in this case) in standard form right away, whereas the longer form shows the expanded form of the quotient (60 + 4) arranged vertically.

Working Together: By rewriting the divisions shown in Ex. 1 and 2, students can think through the procedure, concentrating on the shorter form and then checking their quotients with those on the page. Use other similar exercises needed. Then have the students continue with Ex. 3- Caution them to write each digit of the quotient in t corresponding place above the dividend.

Exercises: Since the shorter form for division does not show t partial quotients stacked above the dividend, the studer do not need to be as concerned about spacing the exercises as in earlier lessons.

Problem Solving: Situations involving buying and selling oft require the use of multiplication and division. Su situations are presented here in considering how purchase items and spend the least amount of money. F such problems, students must consider several possibiliti in order to arrive at the best choice.

Ex. 1 and 2 will establish the price per pencil for a Thr Pack of 5 pencils, a Bargain Pack of 7 pencils, and t pencils sold singly. This information is needed for solvi

Working Together

Show each division in the shorter form.

1. $3\overline{)741}$ → $7 + 40 + 200 = 247$

$$\begin{array}{r} 600 \\ \hline 141 \\ 120 \\ \hline 21 \\ 21 \\ \hline 0 \end{array}$$

247
3)741
600
141
120
21
21
0

2. $7\overline{)270}$ → $8 + 30 = 38$ R4

$$\begin{array}{r} 210 \\ \hline 60 \\ 56 \\ \hline 4 \end{array}$$

38 R4
7)270
210
60
56
4

Divide. Use the shorter form.

3. $4\overline{)692}$ 173
4. $5\overline{)243}$ 48 R3
5. $6\overline{)840}$ 140

Exercises

Divide. Use the shorter form.

1. $2\overline{)96}$ 48
2. $4\overline{)220}$ 55
3. $3\overline{)670}$ 223 R1
4. $5\overline{)165}$ 33
5. $7\overline{)674}$ 96 R2
6. $6\overline{)900}$ 150
7. $8\overline{)384}$ 48
8. $2\overline{)754}$ 377
9. $7\overline{)301}$ 43
10. $4\overline{)870}$ 217 R2
11. $3\overline{)100}$ 33 R1
12. $6\overline{)220}$ 36 R4
13. $8\overline{)904}$ 113
14. $5\overline{)244}$ 48 R4
15. $3\overline{)225}$ 75
16. $2\overline{)599}$ 299 R1
17. $9\overline{)135}$ 15
18. $6\overline{)803}$ 133 R5
19. $5\overline{)420}$ 84
20. $9\overline{)708}$ 78 R6
21. $4\overline{)323}$ 80 R3
22. $6\overline{)102}$ 17
23. $8\overline{)623}$ 77 R7
24. $9\overline{)783}$ 87

What would the calculator show for each quotient?

25. 1221 ÷ 31 = 39.4
26. 1344 ÷ 12 = 112

Division and multiplication help us decide what to buy.

Solve.

1. A Thrift Pack has 5 pencils. It costs 35¢. A Bargain Pack has 7 pencils. It costs 42¢. How much are you paying for each pencil when you buy a Thrift Pack? 7¢ a Bargain Pack? 6¢
2. 3 single pencils sell for 24¢. How much would 5 single pencils sell for? 40¢
3. How could you buy 5 pencils and spend the least amount of money? a Thrift Pack
4. How could you buy 10 pencils and spend the least amount of money? a Bargain Pack and 3 single pencils
5. How could you buy 20 pencils and spend the least amount of money?

2 Bargain Packs
1 Thrift Pack
1 single pencil

PROBLEM SOLVING

Ex. 3-5. For example, for Ex. 4, 10 pencils may be purchased as follows:

10 single pencils	$10 \times 8¢ = 80¢$
2 Thrift Packs	$2 \times 35¢ = 70¢$
1 Bargain Pack and 3 single pencils	$42¢ + 24¢ = 66¢$

Ex. 5 can demonstrate that it is less expensive to buy 3 Bargain Packs of 7 pencils and obtain 21 pencils than it is to buy exactly 20 pencils.

Have the students name the amounts of money they would spend for Ex. 3-5 and learn from one another's answers that there may be a cheaper way to buy the items suggested.

Assessment

Divide. Use the shorter form.

1. $4\overline{)96}$ 24
2. $2\overline{)480}$ 240
3. $8\overline{)492}$ 61 R4
4. $5\overline{)844}$ 168 R4

RELATED ACTIVITIES

- Students having difficulty with the shorter form for division may need help with the multiplication steps for the hundreds' place and the tens' place. Exercises similar to the following may be helpful. Models may be used to further clarify the products.

8×1 hundred = 800
8×6 tens = 480
4×2 hundreds = ____
4×5 tens = ____
3×3 hundreds = ____
3×8 tens = ____
6×1 hundred = ____
6×1 ten = ____
5×1 hundred = ____
5×7 tens = ____

- You may wish to have students check their divisions by using multiplication. (See Ex. 23 and 24 on page 266.)
- Some students may develop competence with the shorter form of division by practicing with simple exercises first. The difficulty can be increased as students improve. Some suggestions for exercises are given below.

1.	$2\overline{)42}$	$3\overline{)39}$	$5\overline{)55}$
2.	$2\overline{)52}$	$3\overline{)48}$	$5\overline{)75}$
3.	$2\overline{)642}$	$3\overline{)639}$	$5\overline{)555}$
4.	$2\overline{)452}$	$3\overline{)648}$	$5\overline{)575}$

Page 270

OBJECTIVE

Solve problems having more than one solution

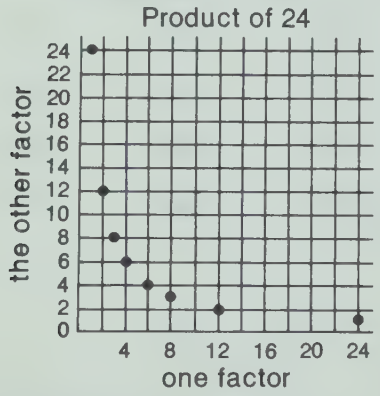
Materials

copies of pages T 367 and T 368 (optional)

RELATED ACTIVITIES

• For enrichment, have students write pairs of factors of a number in a table as shown below. The results may be shown on a graph. The students can observe that the points appear to form a curve.

Product of 24	
one factor	the other factor
1	24
2	12
3	8
24	1



LESSON ACTIVITY

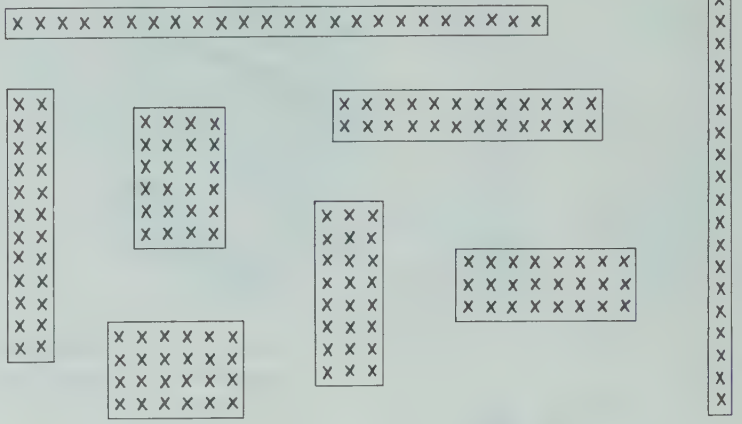
Using the Page

• You may wish to begin this lesson by giving each student a copy of page T 367 and asking them to cut out a rectangle that contains 24 of the small squares. A display of their results can indicate that this problem has more than one solution. The solutions can be compared with the arrays shown on page 270. Discuss that the arrays can be considered in pairs which are associated with the same two factors, such as 1 and 24 for 1×24 and 24×1. Summarize that objects packed in cartons are usually in the form of a rectangular array (cans in a box, bottles in a case).

You may wish to provide students with copies of page T 368 on which to show their answers for Ex. 1-5.

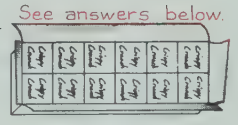
More Than One Solution

There are many ways to arrange 24 items in a rectangular array.



1. Here is the shape of one carton that would hold a dozen boxes. Show the shape of another carton that would hold a dozen boxes in a different rectangular array.

See answers below.



2. Show the shapes of two different cartons that would each hold 30 boxes in rectangular arrays.
3. Show the shapes of all the different cartons that would each hold 18 boxes in rectangular arrays.
4. Show the shape of a carton that would hold 24 boxes in 2 rectangular arrays, one on top of the other.
5. 144 cans are packed 6 to a carton. How many cartons are needed? Draw an array that you can make with the cartons. Draw the cans in the cartons and count how many rows and columns are in the array of cans.

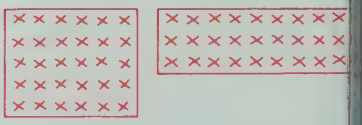
PROBLEM SOLVING

270

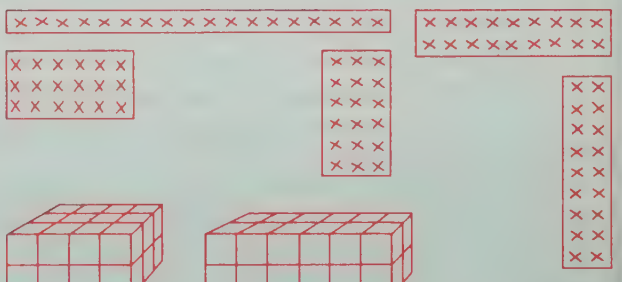
Page 270

1.

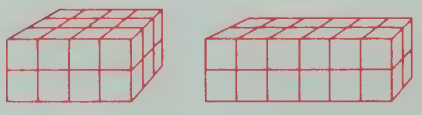
2.



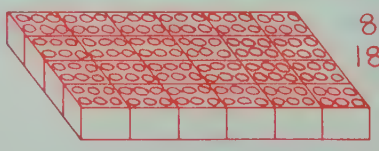
3.



4.



5. 24 Other arrays are possible.



8 rows of cans
18 columns of cans

Checking Up

Write the quotient.

1. $3\overline{)18}$ 6
2. $7\overline{)49}$ 7
3. $9\overline{)27}$ 3
4. $5\overline{)45}$ 9
5. $8\overline{)48}$ 6
6. $6\overline{)24}$ 4

Write the quotient and the remainder.

7. $4\overline{)22}$ 5 R2
8. $2\overline{)13}$ 6 R1
9. $9\overline{)78}$ 8 R6
10. $6\overline{)40}$ 6 R4
11. $8\overline{)63}$ 7 R7
12. $7\overline{)31}$ 4 R3

Solve.

13. The 8 children shared $32 equally. How much did each child get? $4

14. 32 pennies were stacked in groups of 5. How many stacks were there? 6 How many pennies were left over? 2

Divide.

15. $4\overline{)80}$ 20
16. $2\overline{)60}$ 30
17. $3\overline{)30}$ 10
18. $3\overline{)96}$ 32
19. $2\overline{)42}$ 21
20. $4\overline{)88}$ 22
21. $3\overline{)693}$ 231
22. $2\overline{)846}$ 423
23. $4\overline{)480}$ 120
24. $2\overline{)56}$ 28
25. $6\overline{)84}$ 14
26. $3\overline{)78}$ 26
27. $2\overline{)674}$ 337
28. $4\overline{)896}$ 224
29. $3\overline{)951}$ 317
30. $7\overline{)427}$ 61
31. $4\overline{)288}$ 72
32. $3\overline{)249}$ 83
33. $8\overline{)984}$ 123
34. $3\overline{)705}$ 235
35. $9\overline{)513}$ 57
36. $7\overline{)392}$ 56
37. $5\overline{)740}$ 148
38. $6\overline{)516}$ 86

Divide. Write the remainder beside the quotient.

39. $5\overline{)379}$ 75 R4
40. $7\overline{)272}$ 38 R6
41. $4\overline{)642}$ 160 R2
42. $9\overline{)394}$ 43 R7
43. $6\overline{)673}$ 112 R1
44. $8\overline{)629}$ 78 R5

Solve.

45. 732 books were shared equally among 3 schools. How many books did each school get? 244

46. The school ordered 720 pencils in boxes of 5 each. How many boxes of pencils did the school order? 144

47. 256 children were placed in teams of 8. How many teams were there? 32

48. The 4 tables cost $316. They are all alike. How much did each table cost? $79

Find the average.

49. 912 people were at the 4 concerts. 228

50. Debbie scored 105 points in 7 games. 15

51. The scales showed 117 kg for the 3 children. 39

52. The school spent $320 for 8 films. $40

271

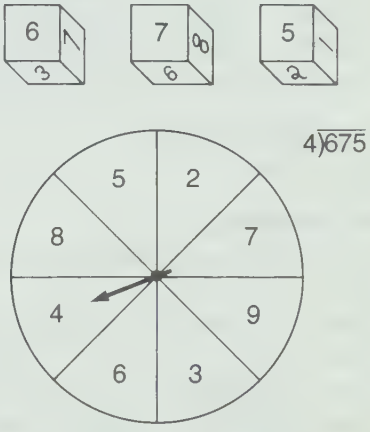
Page 271

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

RELATED ACTIVITIES

- Students may practice division by playing a game in groups of two or three, using a number spinner for the numbers 2 to 9, and three dice marked 0, 1, 2, 3, 4, 5; 4, 5, 6, 7, 8, 9; 2, 3, 4, 5, 6, 7. Each player, in turn, rolls the dice and spins the spinner. The numbers shown on the dice are used to form a dividend. The number shown on the spinner is used as the divisor. Each player finds the quotient and the remainder for her/his numbers. At the end of an agreed number of rounds, each player finds the sum of her/his remainders. The player with the least (or greatest) sum is the winner.



Skills	Exercises	Related Pages
Complete basic division facts	1-6	T 270-T 271
Divide, divisors and quotients to 9, remainders	7-12	T 270-T 271
Divide a multiple of ten from 10 to 90 by a one-digit number, quotients a multiple of ten	15-17	T 272
Divide a two-digit number by a one-digit number, no regrouping, remainder zero	18-20	T 273
Divide a three-digit number by a one-digit number, no regrouping, remainder zero	21-23	T 274-T 275
Divide a two-digit number by a one-digit number, regrouping tens as ones, remainder zero	24-26	T 276-T 277
Divide a three-digit number by a one-digit number, regrouping tens as ones, remainder zero	27-29	T 280-T 281
Divide a three-digit number by a one-digit number, regrouping hundreds as tens, quotients to 99, remainder zero	30-32	T 282-T 283
Divide a three-digit number by a one-digit number with one or two regroupings	33-44	T 284-T 285
Use division to find an average	49-52	T 286-T 287
Solve division problems	13, 14, 45-48	

Comments

Students having difficulty may find it helpful to continue the use of models to find the quotient, sharing place by place and regrouping as needed.

If errors in division are a result of poor recall of basic multiplication facts, it may be advisable to have students refer to a table of basic multiplication facts as needed (see page T 350) and to provide opportunities for them to memorize the facts.

Unit 12 Overview

Measurement

This unit reviews and extends some of the linear units of measurement which were presented in Unit 9. In addition to these, units of time, mass, and capacity are introduced. All the work is related closely to activities and items of everyday life in which the units are used. Units of time include seconds, minutes, hours, days, weeks, months, and years, and conversions are made between some of them. The 24-hour clock is presented alongside the 12-hour clock so that students may become familiar with the two different methods of indicating time. Linear units of measurement are related to specific situations from life. Exercises require selecting the most appropriate unit in a given situation and estimating lengths in terms of that unit. There are no conversions between any of the linear units, but the millimetre is introduced with its relationship to the familiar centimetre. For measuring capacity and mass, the millilitre and litre and the gram and kilogram are presented and conversions are made between the two units of each type. One lesson on bar graphs deals with data which are given in units of length, capacity, and time. Estimating answers to problems drawn from everyday life is the problem-solving skill in this unit. Informal techniques are required in real-life situations. In addition to the *Checking Up* lesson at the end of the unit, skills in the four basic number operations and in solving related problems are assessed in four sets of exercises.

Prerequisite Skills

- read a scale

Unit Outcomes

- demonstrate an understanding of length, capacity, mass, and time
- compare objects with respect to length, capacity, mass, and time
- choose the preferred unit of time from seconds, minutes, hours, days, weeks, months, years; relate units of time
- write numerals for times to the minute for a 12-hour clock using a.m. and p.m.
- express times given in terms of a 12-hour clock as times on a 24-hour clock and vice versa; add and subtract times
- identify the millimetre as a standard unit for measuring length
- choose the best estimate for the length of an object
- choose the preferred unit of length from millimetre, centimetre, metre, kilometre
- identify the millilitre as a standard unit for measuring capacity; choose the best estimate for the capacity of a container
- identify the gram as a standard unit of mass; choose the best estimate for the mass of an object
- express millilitres as litres and millilitres, and litres as millilitres; solve related word problems
- express grams as kilograms and grams, and kilograms as grams; solve related word problems
- draw bar graphs to represent sets of data
- estimate answers to problems, using a variety of informal methods

Background

The origin of the metric system of measurement and its rec updating and international acceptance are discussed in Overview for Unit 9. You may wish to reread page T 218.

The decimal nature of the metric system permits prefixes to used with any base unit. In some areas of measurement ma different terms are used, while in others only a few commonly used. Theoretically, the complete set would inclu the prefixes shown in the chart at the right. For linear measure, the most common units are *kilometre*, *metre*, *centimetre*, and *millimetre*; for capacity, only the *kilolitre*, *litre*, and *millilitre* are used to any great extent; and for mass, the most widely used units are the *milligram*, *gram*, *kilogram*, and *tonne* (1000 kg).

kilo	—	1000
hecto	—	100
deca	—	10
	—	1
deci	—	0.1
centi	—	0.01
milli	—	0.00

Whereas in the English system of measures, fractions were used frequently in such expressions $3\frac{1}{4}$ miles, $2\frac{1}{2}$ gallons, and $4\frac{1}{2}$ tons, fractions are not used w metric units. If necessary, a decimal is used to indicate part o unit, or to avoid a decimal the unit is changed to a smaller u by multiplying by a power of 10. For example, 1.5 L indica one and one-half litres, but this can be converted to millilitres multiplying by 1000, giving 1500 mL. Similarly, a mass 3475 g can be expressed as kilograms by dividing by 10 giving 3.475 kg. The decimal structure of the metric systen probably its most commendable feature.

Time is not measured in a metric or decimal system. *second* is a recognized SI unit, and decimals are used to indic parts of a second. Other common units of time related to second, such as minute, hour, and day, are accepted and u internationally although they are not metric units. Some symb for units of time use a single letter, one is an abbreviation (without a period), and some have no international symbol. The work in this unit follows the approved style for SI notation shown at the right, with the exception of the symbol "a", which is derived from the Latin word *annum*, meaning year.

Unit	Symbo
second	s
minute	min
hour	h
day	d
week	
month	
year	a

Since there are 24 hours in a day and only 12 hours are shown on a 12-hour clock, it is necessary to indicate whether any given time before noon or after noon. The abbreviations a.m. and p.m. derived from the Latin words *ante meridiem* (before midd and *post meridiem* (after midday). Times are written to show

12-hour clock	24-hour clock
6:00 a.m.	06:00
1:13 p.m.	13:13
7:45 p.m.	19:45

hours and minutes, separated by a colon, and followed by ei a.m. or p.m., as in 10:25 a.m. and 6:15 p.m. On a 24-h clock, time begins at 00:00 (midnight) and continues past 1 (noon) through 13:00 (1:00 p.m.) and 14:00 (2:00 p.m.), an on, to 24:00 (midnight). Thus, four digits are always use represent times, two digits for hours separated by a colon f two digits for minutes. Sometimes a colon is not used, b

ce is then left between the hours and the minutes. For ance, 6:15 p.m. could be written as 18:15 or 18 15. Reading es and telling others of specific times on the basis of a hour clock involves expressions such as the following.

he first New Year's baby was born at zero-o-eight.'' (00:08)

he plane is scheduled to arrive at twenty-one fifteen.'' 21:15)

he meeting will begin at fourteen hours.'' (14:00)

te that expressing 14:00 as ''fourteen hundred hours'' is orrect because the two zeros do not indicate hundred — ther hundreds of minutes, nor hundreds of hours.

aching Strategies

Activities suggested in the teaching outlines for the lessons, as ll as those indicated in the text, require a variety of materials. ese should be available not only during the directed lessons, also before and after the lessons so that students may benefit m both informal and planned experiences using measures. ce there may be limited quantities of some materials and ce both the experiences and the ensuing discussions may duce some bustling and movement about the room, it may be visable to form several instructional groups. These may be uctured without regard to the computational skills of the dents because no computation is involved with the measures. s important, however, that students maintain their skills in rking with numbers — exercises in *Try This* on page 275 and *Keeping Sharp* on pages 283 and 285 may be assigned at any e during the unit. The exercises in *Checking Skills* at the end the unit may also be used at any time, and appropriate eaching and practice can be planned to overcome any ntified weaknesses.

For the lessons on capacity, arrangements should be made for dents to have the hands-on experiences of actually pouring d measuring. So that each student may have direct experiences this type, it may be necessary to subdivide instructional ups into still smaller groups and to schedule their participa- n at various times of the day. Students may contribute to the uired materials by bringing objects from home, such as pty plastic bottles and other containers for pouring and asuring. Objects may be brought for measuring mass. To vent spills, a sink or water table is advised if liquids are used, d a sand table if dry substances, such as sand, sawdust, or in, are used. Even a large dishpan or tub placed on a plastic eet can minimize spillage of the materials.

aterials

monstration clock with movable hands
electric dial clock and an electric digital clock (optional)
ers marked in millimetres and in centimetres
tre sticks marked in centimetres and in millimetres
e-litre containers labeled ''one litre''
riety of containers that hold less than one litre
agazines and newspapers (optional)
lance scales
e-kilogram masses marked with the label ''one kilogram''
jects for measuring mass, such as golf balls, nails, dried beans
ss of 500 g (optional)
pies of page T 368 and a ruler for each student

Vocabulary

length
capacity
mass
time
seconds, s
minutes, min
hours, h
days, d
words for times to the minute
12-hour clock
24-hour clock
a.m., p.m.
kilogram, kg
millimetre, mm
litre, L
millilitre, mL
gram, g

Pages 272-275

OBJECTIVE

Demonstrate an understanding of length, capacity, mass, and time; compare objects with respect to length, capacity, mass, and time

Vocabulary

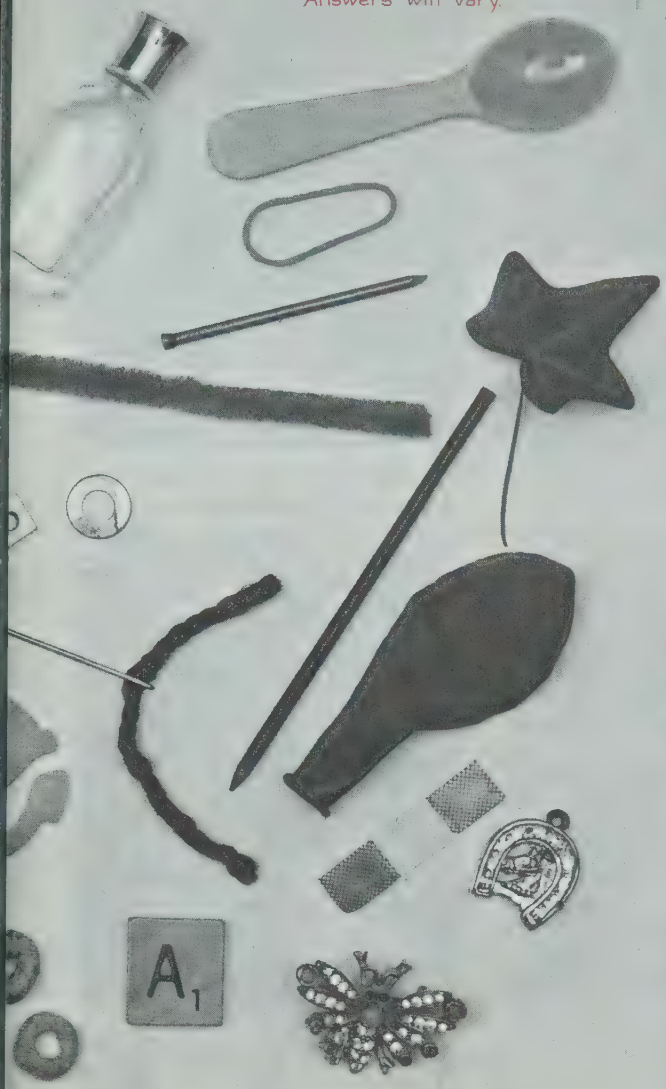
length, capacity, mass, time

12 MEASUREMENT
Small Amounts
The thimble is shorter than the match, heavier than a grain of rice, and would hold less water than the balloon.
It takes you longer to read that sentence than this one.
272

LESSON ACTIVITY

Using the Pages

- In this lesson, students consider very small objects to prepare them for the concept of small units of measure in the following lessons. Since the units of measure concern length, capacity, mass, and time, these four aspects of measurement are reviewed and clarified.
- Begin by having students identify as many objects as possible in the photograph on pages 272 and 273. Develop that one attribute common to all these objects is their ''smallness''. For example, the safety pin is short, the key is very light, the bottle cap would hold just a little liquid, and the pin is very thin. Have a student read the statements at the top of page 272 to introduce the comparison of pairs of objects shown. Have students suggest other similar comparisons.



Answers will vary.

Working Together

Name two objects that you think

1. are shorter than the nail.
2. are thinner than the round cereal.
3. are lighter than the marble.
4. hold less than the bottle.

Which object do you think is

5. the lightest?
6. the thinnest?

Which can you do more quickly,

7. blow up a balloon or pound a nail?
8. unlock a lock or open a safety pin?

Which can you do most quickly,

9. open a chain, put on a key, or close the chain?

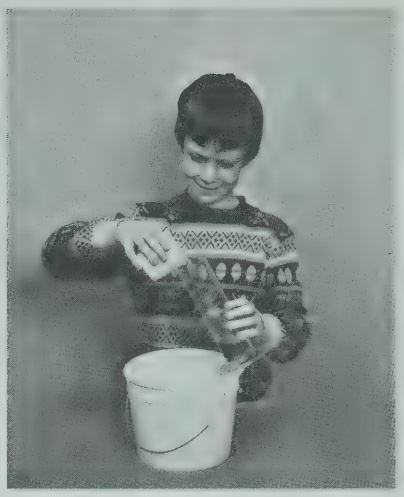
Which takes the longest time,

10. a blink, a sneeze, or a shiver?

Now try the exercises on page 275.

Working Together: For many of these exercises, the students' answers will vary. Emphasis is not on accuracy (for obvious reasons), but on encouraging students to compare small objects with respect to length, capacity, mass, and time.

To find how long an object is, you measure its **length**.



To find how much a container holds, you measure its **capacity**.

To find how heavy an object is, you measure its **mass**.

To find how quickly something happens, you measure **time**.

Exercises Answers will vary.

Use the picture on pages 272–273.

Which do you think is longer,

1. the feather or the match?
2. the yarn or the pipe cleaner?

Which do you think holds more,

3. the nutshell or the spoon?
4. the trophy or the pen cap?

Which do you think is heavier,

5. the bandage or the pushpin?
6. the ring or the jack?

Which takes more time,

7. sewing a button or buttoning a coat?
8. sharpening a pencil or writing your name?

Make a chart like this.

	Length	Mass	Capacity	Time
9.				
10.				
11.				

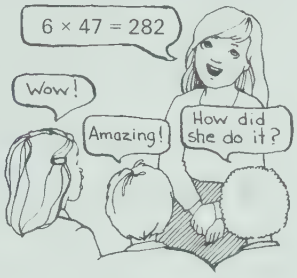
Use a check to show whether you would measure length, capacity, mass, or time.

9. How long is a ladybug? length
10. How much ink is in a pen? capacity
11. How long between two hiccups? time
12. How much milk can a straw hold?
13. How light is a feather? mass capacity
14. How thin is a dime? length
15. How heavy is a butterfly? mass
*16. How big is a thimble? capacity

Learn how to multiply this way without using paper or pencil and dazzle your friends!

For 6×47, think

$47 = 40 + 7$, so
$6 \times 47 = (6 \times 40) + (6 \times 7)$
$6 \times 40 = 240$
$6 \times 7 = 42$
$6 \times 47 = 282$



Complete.

1. $8 \times 32 = (8 \times 30) + (8 \times 2)$
   or $240 + 16$
   $8 \times 32 =$ 256
2. $4 \times 76 = (4 \times$ 70 $) + (4 \times$ 6 $)$
   or 280 + 24
   $4 \times 76 =$ 304

Now, try these.

3. 5×67 335
4. 3×26 78
5. 2×85 170
6. 7×39 273
7. 9×56 504
8. 4×79 316
9. 7×48 336
10. 8×94 752

try this

275

RELATED ACTIVITIES

- You may wish to provide other exercises similar to those in *Try This*. Students may compute the products mentally and write their answers. Begin with simpler exercises similar to the ones below. These have a multiple of one hundred as the first partial product, and the addition step is easier to compute mentally.

  5×24 6×52
  5×43 8×56

- The students may be interested in collecting objects similar to those shown on pages 272 and 273. Have them bring items from home and help to arrange them on a display board. A list of questions similar to those on page 275 may be prepared and displayed with the objects.

xercises: Begin with a discussion of the photographs on page 274. Ask what is being measured in each case. For example, in the top left photograph, the height of the cup is being measured. Have students suggest other examples of measurement similar to these. Have them associate the terms *length*, *capacity*, *mass*, and *time* with their examples.

Remind the students to refer to the photograph on pages 272 and 273 for these exercises. Ex. 9-16 can help you determine whether students understand the different kinds of measurement (length, capacity, mass, time). The photographs and statements on page 274 can be of assistance if students are in doubt. Ex. 16 can motivate a discussion about the interpretation of the word "big". For example, does it refer to height, mass, capacity, or to all of these? The students can conclude that the word "big" has more than one meaning, and its meaning is dependent on the situation in which it is used.

Try This: These exercises demonstrate the use of the distributive property of multiplication over addition to compute the product of a two-digit number and a one-digit number. With practice in applying this property, students can compute such products mentally rather than in writing. You may wish to discuss that in using the standard algorithm, multiplication and regrouping are carried out in a right-to-left order. In using the method shown on this page, the multiplication is carried out from left to right to obtain the partial products, and these are then added for the final product.

Pages 276-277

LESSON OUTCOME

Choose the preferred unit of time from seconds, minutes, hours, days, weeks, months, years; relate units of time

Vocabulary

seconds, s; minutes, min; hours, h; days, d

Units of Time

Ann and Bev have 3 h to spare on Saturday afternoon. Do they have enough time to watch a movie that lasts 150 min?

1 h = 60 min
2 h = 120 min
3 h = 180 min

150 min is between 2 h and 3 h.

s means seconds.
min means minutes.
h means hours.
d means days.

3 h is more than enough time to watch the movie.

Working Together

Complete each table.

1.

min	s
1	60
2	120
3	? 180
4	? 240
5	? 300

2.

h	min
1	60
2	? 120
3	? 180
4	? 240
5	? 300

3.

d	h
1	24
2	? 48
3	? 72
4	? 96
5	? 120

4.

weeks	d
1	7
2	? 14
3	? 21
4	? 28
5	? 35

5.

years	1	2	3	4
months	12	? 24	? 36	? 48
days	365	? 730	? 1095	? 1460

plus one more day every fourth year

Use your tables to help you with these.

6. 3 weeks = 21 d
7. 30 h = 1, 6 d h
8. 1001 d = 2, 271 years d
9. 1 year 4 months = 16 months

Tell whether you would use seconds, minutes, hours, or days to measure the time it takes

10. to bake a cake. minutes
11. to sharpen a pencil. seconds
12. to grow a flower. days

276

LESSON ACTIVITY

Using the Pages

- The word problem presents a situation for which it is necessary to express hours as minutes, in order to solve the problem. Have the students study the example and then ask them questions to determine their understanding of the solution and of the symbols for units of time. Some students may suggest a different way to solve the problem by expressing 150 min as 2 h 30 min. Ask whether the students would have enough time to watch a 200 min movie.

Working Together: Ex. 1-5 help to establish the relation between pairs of units of time. Note that, in most cases, the relations deal with consecutive units, for example, seconds and minutes, or minutes and hours, and not pairs such as seconds and hours, or hours and weeks.

Ex. 5 can motivate a discussion of why one more day needed every fourth year. You may wish to introduce th term *leap year*. In completing the tables for Ex. 1-5, th students apply their skills in multiplication, and th completed tables are useful in answering Ex. 6-9. Ex 10-12 deal with choosing the preferred unit and examin the students' understanding of the duration of units of time A discussion of the students' answers would enable them t give reasons for their choice.

Exercises: Have the students refer to their completed table from *Working Together* as needed. Note that althoug exercises such as Ex. 8 imply the use of division $(60\overline{)150}$ the tables will be used to complete such exercises an division (in this case, division by a two-digit number) is no used.

For Ex. 24, you may wish to discuss how the 360 s i obtained for a distance of 8 km.

Exercises

Use your tables to help you with these.

1. 5 min = ▒ s 300
2. 36 months = ▒ years 3
3. 6 weeks = ▒ d 42
4. 144 h = ▒ d 6
5. 50 h = ▒ d ▒ h 2, 2
6. 2 h 20 min = ▒ min 140
7. 2 min 10 s = ▒ s 130
8. 150 min = ▒ h ▒ min 2, 30
9. 30 d = ▒ weeks ▒ d 4, 2
10. 200 s = ▒ min ▒ s 3, 20
11. 3 years 7 months = ▒ months 43
12. 2 d 4 h = ▒ h 52
13. 1 year 30 d = ▒ d 395
14. 2 weeks 3 d = ▒ d 17
15. The child is 20 months old. This is the same as ▒ year ▒ months. 1, 8
16. A duck's egg takes 30 d to hatch. This is the same as ▒ weeks ▒ d. 4, 2

Tell whether you would use seconds, minutes, hours, days, weeks, months, or years to complete each sentence.

17. The egg was boiled for 3 ___?___ minutes.
18. The roast was cooked in 3 ___?___ hours.
19. John had a cold and missed 3 ___?___ days of school.
20. Spring, summer, fall, and winter are each 3 ___?___ months long.
21. Ellen blew out the candles on her cake in 3 ___?___ seconds.
22. In 3 ___?___ years we will be in the seventh grade.
23. The Kinsey family went on vacation for 3 ___?___ weeks.

Solve.

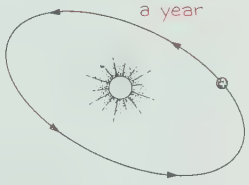
24. A car that travels 1 km in 45 s will travel 8 km in 360 s. How many minutes will it take the car to travel 8 km? 6
25. For each kilogram, the roast should cook 40 min. How many minutes are needed to cook a 3 kg roast? How many hours? 2 120

Does it take a day, a month, or a year?

*26. a day

*27. a month

*28. a year



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RELATED ACTIVITIES

- Students may be interested in investigating the time required for other planets to orbit the sun (in terms of Earth days and years). This can lead to a discussion of the length of a "year" on Mars, Venus, and so on.
- Research in the school library can lead to other facts similar to the one described in Ex. 16 and can suggest similar exercises.

Ex. 26-28 will require the students to interpret the diagrams as follows:

Ex. 26 — the time it takes the earth to rotate on its axis;
Ex. 27 — the time it takes the moon to orbit the earth;
Ex. 28 — the time it takes the earth to orbit the sun.

sessment

mplete.

3 min = ▒ s 180
2. 34 d = ▒ 4 weeks ▒ 6 days
3 d 2 h = ▒ h 74
4. 400 d = ▒ 1 year ▒ 35 days

oose the unit from the list that best completes each sentence.

The cake takes 1 ___h___ to bake.
The movie lasts for 135 ___min___.
It takes about 20 ___s___ to blow up a balloon.

s	h
min	d

Pages 278-279

LESSON OUTCOME

Write numerals for times to the minute for a 12-hour clock using a.m. and p.m.; express times given in terms of a 12-hour clock as times on a 24-hour clock and vice versa; add and subtract times

Materials

demonstration clock with movable hands, an electric dial clock and an electric digital clock (optional)

Vocabulary

12-hour clock, 24-hour clock, a.m., p.m., words for times to the minute

Page 278

3.

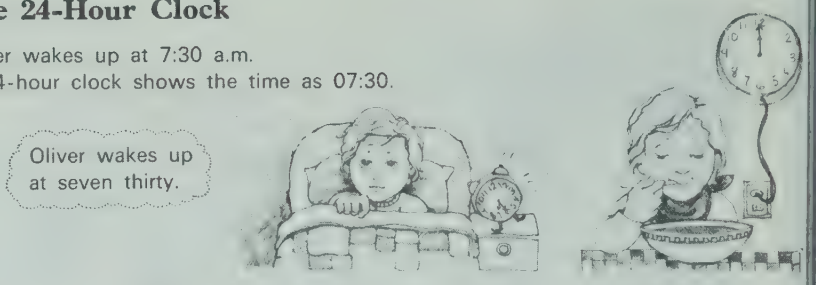
12-hour clock	24-hour clock
9:00 a.m.	09:00
10:00 a.m.	10:00
11:00 a.m.	11:00
12:00 noon	12:00
1:00 p.m.	13:00
2:00 p.m.	14:00
3:00 p.m.	15:00

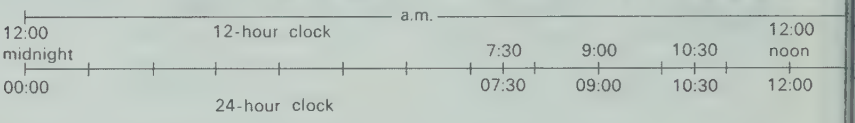
4.

12-hour clock	24-hour clock
9:15 p.m.	21:15
10:15 p.m.	22:15
11:15 p.m.	23:15
12:15 a.m.	00:15
1:15 a.m.	01:15

The 24-Hour Clock

Oliver wakes up at 7:30 a.m.
A 24-hour clock shows the time as 07:30.





Working Together

For a 12-hour clock, **a.m.** names times before noon and **p.m.** names times after noon.
Write the time using a.m. or p.m.

1. six o'clock in the morning 6:00 a.m.
2. four thirty in the afternoon 4:30 p.m.

Continue the pattern to 3:00 p.m.

3.

12-hour clock	24-hour clock
9:00 a.m.	09:00
10:00 a.m.	10:00

Continue the pattern to 01:15.

4.

12-hour clock	24-hour clock
9:15 p.m.	21:15
10:15 p.m.	22:15

Answers for Ex. 3 and 4 are shown at the left.

Complete.

5. 8:00 p.m. is ___ h past noon. 8
For 8:00 p.m., a 24-hour clock shows ___. 20:00
6. 17:00 is ___ h past noon. 5
For 17:00, a 12-hour clock shows ___. 5:00 p.m.

Complete the chart.

7.

12-hour clock	? (8:50 a.m.)	5:10 p.m.	3:35 a.m.	? (7:45 p.m.)	? (12:30 a.m.)
24-hour clock	08:50	? (17:10)	? (03:35)	19:45	00:30

If the time is

8. 11:15 a.m., what time will it be in 2 h 10 min? 1:25 p.m.
9. 13:45, what time was it 4 h 45 min earlier? 09:00

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LESSON ACTIVITY

Before Using the Pages

- If the two electric clocks are not available (see *Materials*), several days before this lesson have students tell the time shown on the classroom clock at different times throughout the day. Have the students write the numerals for the times. As a variation, write numerals for times on the board, for example, 9:20, 10:55, 11:03, 2:30, 3:00, and have students draw attention to the classroom clock when these times are shown. Discuss the positions of the hands of the clock for each time.

  If the two electric clocks are available, several days before the lesson set them going side by side. Follow the suggestions outlined above.

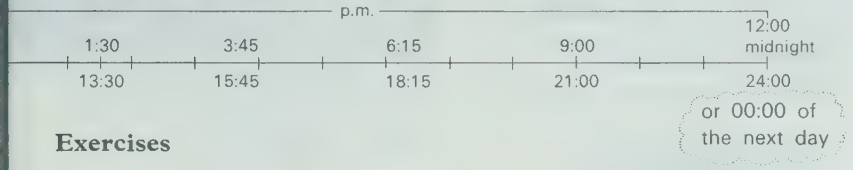
Using the Pages

- The illustrations across the top of these two pages show "one day in the life of Oliver". Specific times for events in the day are given in terms of both kinds of clocks, the 12-hour clock and the 24-hour clock. Have students suggest what is taking place in each of the four illustrations and associate each with one part of the day (morning, noon, afternoon, evening).

  Ask what time Oliver wakes up in the morning and what time he goes to bed. Students will likely name these times according to a 12-hour clock. Have the students study the statements at the top of each page. If a digital clock has been in the room, discuss what part of a day is indicated by hours such as 13 and 15. Or, determine whether any students have seen a digital clock and have them explain in terms of a dial clock the meaning of times such as 13:00 and 15:00. Summarize that there can be two ways of writing times, one way for a 12-hour clock and one way for a 24-hour clock.

- A discussion of the "time line" for Oliver's day can help students relate pairs of numerals for the same times. Have students note the similarity in writing times before noon and the difference in writing times after noon. Emphasize the following aspects.

Oliver goes to bed at 9:00 p.m.
A 24-hour clock shows the time as 21:00.



Exercises

Copy and complete the chart.

	12-hour clock	24-hour clock
1.	6:30 a.m.	06:30
2.	9:24 a.m.	? 09:24
3.	11:43 a.m.?	11:43
4.	1:10 p.m.	? 13:10
5.	11:50 p.m.?	23:50

What would a 24-hour clock show

12. for 3 h later than 4:05 p.m.? 19:05
13. for 1 h 10 min earlier than 12:30 p.m.? 11:20

What would a 12-hour clock show

14. for 5 h 30 min later than 09:15? 2:45 p.m.
15. for 2 h 10 min earlier than 15:18? 1:08 p.m.

What time would be shown on a 12-hour clock and on a 24-hour clock when

6. you wake up? Answers will vary
7. school begins?
8. morning recess ends?
9. you start lunch?
10. you get home from school?
11. you go to bed?

Cindy Nicholas swam from England to France and back to England. She began her swim at 07:50. After 8 h 58 min she reached France. It took her 10 h 57 min to return to England.

*16. At what time did she reach France? 16:48
*17. At what time did she reach England on her return? 03:45
*18. How much time did she spend swimming? 19h 55min

RELATED ACTIVITIES

• A dial clock face similar to the one below may be constructed using a paper plate, two strips of cardboard, and a pronged paper fastener. The numerals written as shown help students to relate times for 12-hour and 24-hour clocks. Students may make their own clock faces and use them to practice showing and telling times.

• Students may make a simple form of digital clock to use in showing times according to a 24-hour clock. Strips of stiff paper showing the necessary numerals are threaded into four slits in a rectangular sheet of cardboard. The ends of each strip are joined to form a movable loop.

One student may show a time on a paper plate clock face that does not show the numerals 13 to 24. A partner may show the 24-hour clock numeral for that time on the digital clock.

1. The symbols a.m. and p.m. are used in naming times according to a 12-hour clock, to identify whether the time is before noon or after noon.
2. Since there are 24 hours in the day, the numerals 13 to 23 (or 24) can be used to identify hours after noon.
3. For a 24-hour clock, two digits are always used to name the hour as in 07:30 (seven thirty) and 21:00 (twenty-one hours).

orking Together: Ex. 1 and 2 deal with the use of a.m. and p.m. Completing the patterns in Ex. 3 and 4 helps students to relate numerals for the same time. Ex. 5 and 6 establish the thought process for writing two numerals for the same time. This process is applied in completing Ex. 7. Ex. 8 and 9 involve addition and subtraction of times. Students may note that addition and subtraction of times according to the 24-hour clock is much like these operations with whole numbers. (The exercises do not involve regrouping between minutes and hours.) It is helpful to add (or subtract) the minutes first and then the hours.

Exercises: Note that answers will vary for Ex. 6-11, but ensure that the times named are reasonable and that the numerals for the times are correct. Ex. 16-18 involve the skill of choosing the necessary information to solve the problem. Also, the addition of times involves regrouping minutes as hours, and this may challenge a few students.

Assessment

What would a 24-hour clock show for

1. 8:30 a.m.? 08:30
2. 2:43 p.m.? 14:43
3. 2 h later than 3:10 p.m.? 5:10 p.m.
4. 1 h 15 min earlier than 12:40 p.m.? 11:25 a.m.

What would a 12-hour clock show for

5. 09:20? 9:20 a.m.
6. 18:08? 6:08 p.m.
7. 2 h 7 min earlier than 15:10? 1:03 p.m.

Page 280

LESSON OUTCOME

Identify the millimetre as a standard unit for measuring length; choose the best estimate for the length of an object

Materials

rulers marked in millimetres and in centimetres

Vocabulary

millimetre, mm

RELATED ACTIVITIES

- The students may draw several line segments and measure the lengths in millimetres.
- Have students use their millimetre rulers to measure various objects in the photograph on pages 272 and 273.
- Students may investigate the meaning of terms such as "35 mm camera".
- Have students complete charts similar to the following.

1 cm	10 mm
2 cm	20 mm
3 cm	30 mm

Length in Millimetres

The **millimetre** (mm) is a standard unit of length.

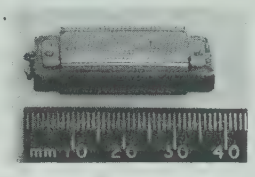
A dime is about 1 mm thick.

The millimetre ruler shows that the hole in the record measures between 7 mm and 8 mm.

10 mm = 1 cm

Working Together

Give the measurement in millimetres.

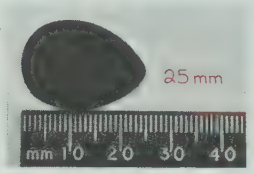
1. 

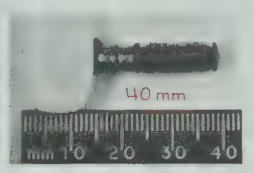
Choose the best estimate for

2. a shirt buttonhole.
   1 mm (10 mm) 100 mm
3. the eye of a fly.
   (1 mm) 1 cm 20 mm

Exercises

Give each measurement in millimetres.

1. 

2. 

A flat toothpick is about 1 mm thick.

3. Look around. Name two other items that have a measurement of about 1 mm.

Answers will vary

Choose the best estimate for

4. the diameter of a pencil lead.
   (1 mm) 10 mm 20 mm
5. the width of your thumbnail.
   1 mm (1 cm) 100 mm
6. the length of an apple seed.
   1 mm (5 mm) 10 mm
7. the thickness of this book.
   1 mm 10 mm (20 mm)
8. the height of a stack of 10 sheets of paper.
   (1 mm) 10 mm 2 cm
*9. the height of a stack of dimes that are worth $1.00.
   1 mm (1 cm) 100 mm

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LESSON ACTIVITY

Before Using the Page

- Have students name the preferred unit of measure (metre, decimetre, centimetre) for measuring such lengths as the length of a pencil, the height of a piano, and the distance from school to home. Then discuss whether any of these units is suitable for measuring, for example, the width of a narrow ribbon, the thickness of a piece of thin plywood, the width of a fly's wing, the height of a letter on a page, the space between two lines of print on a page.

Using the Page

- Introduce the millimetre as a standard unit of length for measuring very small lengths. Have the students note the spelling of the word *millimetre* and the symbol mm. Point out the millimetre markings and the numerals 10, 20, 30, and so on, on the ruler in the photograph. Have students read the number of millimetres for the width of the hole in the record. Ask how many millimetres appear to be the same length as 1 cm. Have the students compare their ov rulers with the one in the photograph, matching t millimetre edges first and then matching the centime edge with the millimetre edge. Emphasize the fact th 10 mm = 1 cm.

Working Together: Ex. 1 deals with reading a scale marked millimetres. The students will find it helpful to use straight edge on the photograph to match the end of t harmonica with millimetre markings on the ruler. Ex. 2 a 3 deal with estimating length in millimetres.

Exercises: The students may use their rulers to check th estimates for Ex. 4-8. For Ex. 9, they will need to refer the example at the top of the page.

Assessment

Choose the best estimate for the width

1. of a button.
   1 mm 10 mm 20 mm
   10 mm

2. of a hole in the butt
   1 mm 5 mm 10 n
   1 mm

Four Units of Length

The millimetre, centimetre, metre, and kilometre are the units of length that are used the most.

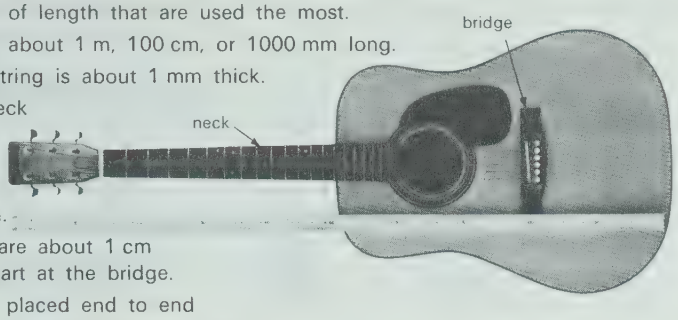
The guitar is about 1 m, 100 cm, or 1000 mm long.

The lowest string is about 1 mm thick.

The guitar neck is about half a metre, 50 cm, or 500 mm long.

Two strings are about 1 cm or 10 mm apart at the bridge.

1000 guitars placed end to end would cover a length of about 1 km.



Working Together

Which unit, the millimetre, the centimetre, the metre, or the kilometre, is best for measuring

1. the thickness of cardboard? millimetre
2. the height of your school? metre

Choose the best estimate for

3. the thickness of a guitar pick.
   (1 mm) 1 cm 1 m
4. the height of a piano bench.
   1 mm (50 cm) 1 m

Exercises

Which unit, the millimetre, the centimetre, the metre, or the kilometre, is best for measuring

1. the width of a TV screen? centimetre
2. the width of a postage stamp? millimetre
3. the length of a drumstick? centimetre
4. a parade route? kilometre
5. the length of the school gym? metre
6. the length of an eyelash? millimetre

Choose the best estimate for

7. the thickness of a pen.
   1 mm (1 cm) 1 m
8. the thickness of a paper match.
   (1 mm) 500 mm 1 m
9. the length of a skateboard.
   1 mm (50 cm) 1 m
10. the length of a baseball bat.
    1 mm 1 cm (1 m)

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Page 281

LESSON OUTCOME

Choose the preferred unit of length from millimetre, centimetre, metre, kilometre; choose the best estimate for a length

Materials

metre sticks marked in centimetres and in millimetres

RELATED ACTIVITIES

- Have students refer to books in the library to discover such things as the height of a giraffe, the distance to the moon, the length of an ant, the length of a snake, the width of a country.

LESSON ACTIVITY

Before Using the Page

- Display a metre stick and have students name its length in different ways (1 m, 10 dm, 100 cm).

Using the Page

- Read the statements that describe the length of the guitar in the photograph. Using the metre sticks available, have students explain how the number 1000 is obtained as the number of millimetres in a metre. Read each of the other statements, in turn, and relate the lengths to the classroom metre sticks as needed. If there are students in the class who are familiar with guitars, perhaps they can suggest why it may be more difficult to play the instrument if the strings are much closer or much farther apart than 1 cm at the bridge.

Working Together: Ex. 1 and 2 help to determine whether students understand the different units of length. This understanding is applied in choosing the best estimate for lengths in Ex. 3 and 4.

Exercises: Note that the decimetre is not encountered here as its use in practical measurement is limited.

Assessment

Which unit, the millimetre, the centimetre, the metre, or the kilometre, is best for measuring

1. the perimeter of a hockey rink? metre
2. the thickness of a skate blade? millimetre
3. the distance to the post office? kilometre

Choose the best estimate for

4. the height of a hockey net. 1 m
   1 mm 500 mm 1 m
5. the thickness of a hockey stick. 1 cm
   1 mm 1 cm 1 m

Pages 282-283

LESSON OUTCOME

Identify the millilitre as a standard unit for measuring capacity; choose the best estimate for the capacity of a container

Materials

one-litre containers labeled "one litre", a variety of containers that hold less than 1 L, magazines and newspapers (optional)

Vocabulary

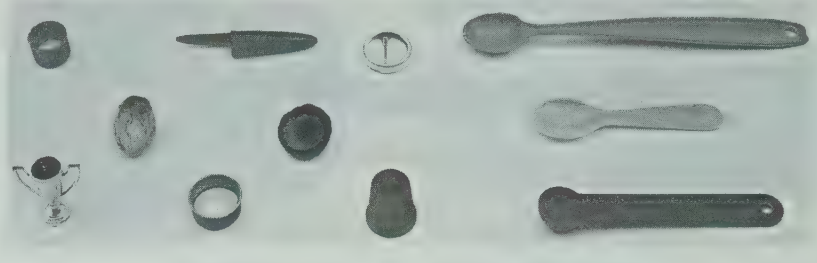
litre, L; millilitre, mL

Capacity in Millilitres and Litres

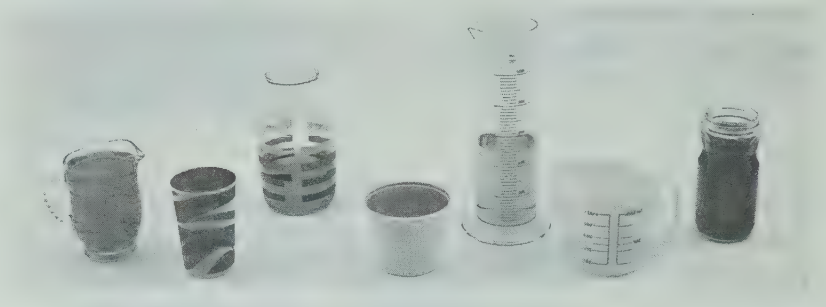
The millilitre (mL) and the litre (L) are standard units for measuring capacity.

Remember that "capacity" is a word for how much something holds.

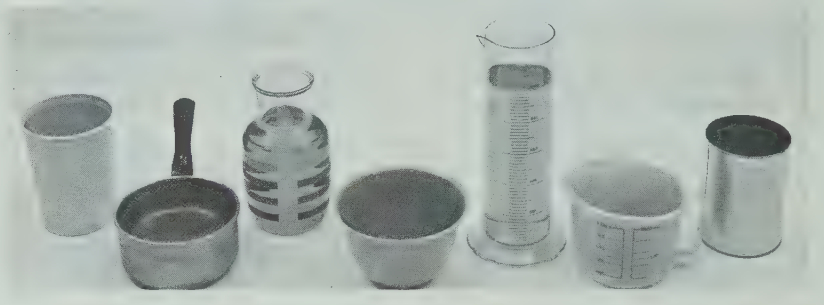
Each of these holds about 1 mL.



There is 500 mL in each of these.
500 mL is half a litre.



There is 1000 mL in each of these.
1000 mL is the same amount as 1 L.



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LESSON ACTIVITY

Before Using the Pages

- Prepare an area of the classroom for activities involving pouring and measuring. A sink or water table with water would be suitable or a table with such materials as rice, wheat, or sand.
- Provide different one-litre containers marked with the label "one litre" (or 1 L) and a variety of other containers that hold less than 1 L. Some suggestions are 1 mL, 10 mL, 100 mL, 200 mL, 250 mL, 500 mL, and 750 mL. Label these containers A, B, C, and so on. Have small groups of students pour and measure to answer questions similar to the following.
  "How many of E are needed to fill the 1 L container?"
  "How many of A are needed to fill B?"
  "Which container holds about half a litre?"
  Have children write answers in a chart.

Needed to fill one litre
10 of C
5 of D
2 of _____

10 of A will fill B
_____ of C will fill F
_____ of E will fill G

Using the Pages

- Review that the *millimetre* was introduced as a unit suitabl for measuring short lengths. Have students study page 28 and then suggest uses for the *millilitre* in measuremen Discuss the similarity in the words *millimetre* and *millilitre* Review the meaning of the term *capacity* and dra attention to the symbols mL and L.
- Have students identify familiar objects and containers in th photographs. Emphasize that 1000 mL = 1 L. Ask ques tions such as the following.
  "Is 1 mL of water enough to boil an egg?"
  "Is 1 mL of toothpaste enough to brush your teeth?"

Working Together

Which unit, the millilitre or the litre, is better for measuring the capacity of

1. a juice glass? millilitre
2. a bathtub? litre

Choose the best estimate for each.

3.

1 mL	(500 mL)	1 L

4.

(1 mL)	500 mL	1 L

Match the capacity of each with A, B, or C

5. a coconut shell	A	between 1 mL and 500 mL
6. the kitchen sink	B	between 500 mL and 1 L
7. a baby's bottle	C	more than 1 L

Exercises

Look around. Name an object with capacity

1. between 1 mL and 500 mL. Answers will vary
2. between 500 mL and 1 L.
3. more than 1 L.

Choose the best estimate for

4. the capacity of a soup can.	1 mL
5. the amount of juice in a cherry.	500 mL
6. how much milk fills four glasses.	1 L

Which best completes each sentence, mL or L?

7. For the party, George made 5 L ? of lemonade.
8. One glass holds 250 mL? of lemonade.

Name two items that are sold by capacity

9. in millilitres.
10. in litres.

Answers will vary.

Multiply or divide.

1.	882 ÷ 7	126
2.	5 × 8.3	41.5
3.	46 × $84	$3864
4.	3 × 290	870
5.	456 ÷ 6	76
6.	760 ÷ 3	253 R1
7.	4 × 353	1412
8.	6 × $4.25	$25.50
9.	$368 ÷ 4	$92
10.	376 ÷ 8	47
11.	298 ÷ 5	59 R3
12.	28 × 58	1624
13.	7 × 108	756
14.	82 × 206	16 892
15.	560 ÷ 5	112
16.	$788 ÷ 2	$394
17.	2 × 67	134
18.	562 ÷ 6	93 R4
19.	35 × 371	12 985
20.	53 × 44	2332
21.	501 ÷ 8	62 R5
22.	950 ÷ 4	237 R2
23.	7 × $47	$329
24.	94 × 76	7144
25.	837 ÷ 9	93
26.	$558 ÷ 3	$186
27.	79 × $3.95	$312.05
28.	564 ÷ 7	80 R4
29.	756 ÷ 9	84

KEEPING SHARP

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RELATED ACTIVITIES

- The students may be interested in preparing a display to show items that are sold by capacity in millilitres and in litres. Have them bring containers (boxes, cans, cartons, jars, and so on) for which the capacity is clearly marked in millilitres or litres. These may involve decimal numerals as in 1.5 L. Students may arrange a set of containers in order of capacity from least to greatest. They may form sets of containers that have different shapes but the same capacity.
- Some baby food jars or cans have a capacity of 100 mL. Students may use one to prepare a measuring device for measuring larger amounts. A 100 mL container of water is emptied into a large container and the level of the water is marked. This process is continued to obtain levels for 200 mL, 300 mL, and so on, to 1 L.
- Challenge the students to find a way of obtaining the marks for 250 mL, 500 mL, and 750 mL on a container that holds 1 L, such as a coffee can. (They may begin by pouring from a one-litre container into two identical containers and judge when each holds the same amount.)
- Provide the students with cylinders and cups marked in millilitres. Have them use these to measure the capacity of various small containers.

"If there is 1 L of milk in the carton and you share it with a friend, how many millilitres of milk are there for each of you?"

"If you drink half your share now, how many millilitres of milk are left for you later?"

This would be an appropriate time to display some of the containers and charts from *Before Using the Pages*. Have students determine the capacity of each container that was used to fill a one-litre container. For example, if 10 of container C filled the one-litre container, C's capacity is 100 mL.

Working Together: Ex. 1 and 2 deal with choosing the preferred unit and can reveal whether students understand the relative sizes of the units. This understanding is applied in choosing the best estimate in Ex. 3-7.

Exercises: If students cannot think of examples for Ex. 9 and 10, you may wish to have them look through magazines and newspapers for suggestions.

Keeping Sharp: These exercises provide practice in the most recently taught concepts and skills in multiplication and division. You may wish to review the procedures by working one or two exercises for each operation on the board with the students.

Assessment

Choose the best estimate for

1. the amount of water in a raindrop. 1 mL
2. how much cocoa fills two mugs. 500 mL

1 mL	500 mL	1 L

Which best completes each sentence, mL or L?

3. The pen refill holds about 8 mL of ink.
4. The package makes about 1 L of soup.

Pages 284-285

LESSON OUTCOME

Identify the gram as a standard unit of mass; choose the best estimate for the mass of an object

Materials

balance scales, one-kilogram masses marked with the label "one kilogram"; objects for measuring mass, such as golf balls, nails, dried beans; magazines, newspapers; a mass of 500 g (optional)

Vocabulary

kilogram, kg; gram, g

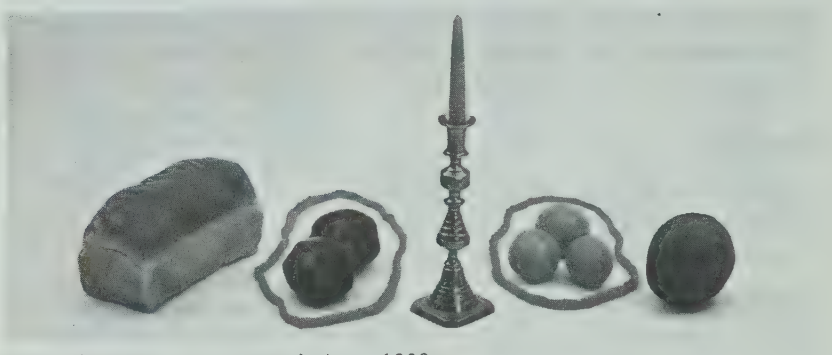
Mass in Grams and Kilograms

The gram (g) and the kilogram (kg) are standard units for measuring mass.

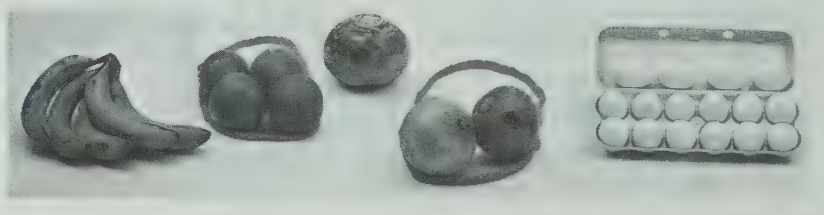
Each of these has a mass of about 1 g.

Remember that "mass" is a word for how much there is of something.

Each of these has a mass of about 500 g.
500 g is half a kilogram.



Each of these has a mass of about 1000 g.
1000 g is the same as 1 kg.



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LESSON ACTIVITY

Before Using the Pages

- Prepare an area of the classroom for activities in measuring mass. A set of balance scales similar to the one shown in the photograph on page 274 would be suitable. Provide one-kilogram masses marked with the label "one kilogram" (or 1 kg) and a variety of objects having masses less than 1 kg. Some examples are books, large scissors, large bolts or screws, and dried peas or beans. Have small groups of students use the scales and the 1 kg mass to answer questions similar to the following.

"How many scissors are needed to balance 1 kg?"
"How many books have a mass of 1 kg?"

If the peas (beans) are placed in plastic bags in amounts of 100 g (250 g), questions similar to the following may be asked.

"How many bags of peas are needed to balance 1 kg?"

The results may be shown in a chart.

These will balance one kilogram.
10 bags of peas
_____ books
_____ scissors
_____ bags of beans

Using the Pages

- Have students study the statements and the photographs o page 284. Have them name objects they recognize in th photographs. Then ask questions such as the following.

"What is meant by the term *mass*?"
"What two units of mass can you name?"
"What is the symbol for each unit?"
"Is a mass of one gram heavier or lighter than a mass o one kilogram?"
"What objects have a mass of about one gram?"
"What objects have a mass of about one kilogram?"

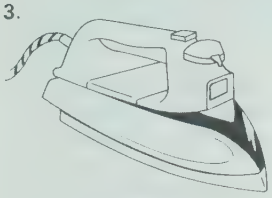
Working Together

Which unit, the gram or the kilogram, is better for measuring the mass of

1. a piano? kilogram
2. a penny? gram

Choose the best estimate for each.

3.



1 g	500 g	(1 kg)

4.

(1 g)	500 g	1 kg

Match the mass of each with A, B, or C.

5. this book	A	between 1 g and 500 g
6. a desk	B	between 500 g and 1 kg
7. a ruler	C	more than 1 kg

Exercises

Look around. Name an object with mass

1. between 1 g and 500 g. Answers will vary
2. between 500 g and 1 kg. 3. more than 1 kg.

Choose the best estimate for the mass of

4. a loaf of bread	1 g
5. a safety pin	500 g
6. a pumpkin	1 kg

Which best completes each sentence, g or kg?

7. The mass of a tennis ball is about 40 g ?.
8. The mass of a desk telephone is about 2 kg?.

Name two items that are sold by mass

9. in grams. 10. in kilograms.
Answers will vary

Add, subtract, multiply, or divide.

1. 2032 − 1346 686
2. 6 × 37 222
3. 5.8 + 6.5 12.3
4. 3.7 − 0.9 2.8
5. 49 × $2.98 $146.02
6. 542 ÷ 8 67 R6
7. $485 + $487 $972
8. 511 ÷ 7 73
9. 30 × 47 1410
10. 806 − 209 597
11. 346 + 959 1305
12. 740 ÷ 2 370
13. $692 ÷ 4 $173
14. 89 × 28 2492
15. 167 ÷ 6 27 R5
16. 23.0 − 9.6 13.4
17. 5 × $4.08 $20.40
18. 18.5 + 17.2 35.7
19. $4.20 − $3.67 $0.53
20. 151 − 54 97
21. 3438 + 3486 6924
22. 2.73 + 8.67 11.40
23. 3 × $654 $1962
24. 4422 − 588 3834
25. 430 ÷ 3 143 R1
26. $9.65 + $4.25 $13.90
27. 37 × 528 19 536
28. 380 ÷ 5 76
29. 8 × 2.8 22.4

KEEPING SHARP

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RELATED ACTIVITIES

- Students may be interested in preparing a display involving grams and kilograms, similar to the display suggested in *Related Activities* on page T 305 for millilitres and litres.
- Have students measure the mass of various objects using balance scales, a set of masses marked in grams, and a one-kilogram mass.
- Have students find the mass of one dollar's worth of pennies, of nickels, of dimes, and of quarters.
- Have students find the mass of 250 mL of different items, such as peas, beans, sand, water, and sawdust.

"What would be the mass of half a loaf of bread?"
"What would be the mass of one orange?"
"What would be the mass of ten birthday candles?"

Working Together: Ex. 1 and 2 deal with choosing the appropriate unit of mass. Use other similar exercises to ensure that the students understand the use of each unit. This understanding is applied in Ex. 3-7. Students may associate the objects for Ex. 3-7 with those in the photograph on page 284 for assistance in choosing the best estimate.

Exercises: You may wish to provide an opportunity for the students to use the balance scales with masses of 500 g and 1 kg to check their answers for Ex. 1-3. Magazines and newspapers may be helpful in answering Ex. 9 and 10.

Keeping Sharp: These exercises provide practice in the four basic operations. Some exercises involve decimals. Remind the students to pay careful attention to the operation symbol for each exercise.

Assessment

Choose the best estimate for the mass of

1. a toaster. 1 kg
2. a paper clip. 1 g

1 g	500 g	1 kg

Which best completes each sentence, g or kg?

3. The mass of a golf ball is about 46 g.
4. The mass of a jug of milk is about 2 kg.

Page 286

LESSON OUTCOME

Express millilitres as litres, and litres as millilitres; solve related word problems

RELATED ACTIVITIES

- Have students examine other recipes from various cookbooks and express the amount of each (appropriate) ingredient as millilitres (or litres and millilitres).
- Have students find the amount of each ingredient required to double or triple a recipe.

Millilitres and Litres

1250 mL of milk is needed for the rice pudding.
Eldon has 1 L of milk. Does he have enough?

PUDDINGS

RICE PUDDING

150 mL rice
300 mL water
5 mL butter
1250 mL milk
150 mL sugar
pinch of salt

Cook the rice, water, and butter over medium heat until the water is almost gone. Add remaining ingredients and cook about 1 h over low heat.

Makes about 6 servings of 225 mL each. 125 mL of raisins can be added.

Eldon has 1 L, or 1000 mL. He needs 1250 mL.
He needs 250 mL more for the rice pudding.

1250 mL = 1 L and 250 mL more.

Working Together

Complete.

1. 2000 mL = [ ] L 2
2. 3 L = [ ] mL 3000
3. 1625 mL = 1000 mL and [ ] mL more. 625
   1625 mL = [ ] L [ ] mL 1, 625
4. 2 L 400 mL = [ ] mL and 400 mL more. 2000
   2 L 400 mL = [ ] mL 2400
5. 4750 mL = [ ] L [ ] mL 4, 750
6. 1 L 750 mL = [ ] mL 1750

Exercises

Complete.

1. 6000 mL = [ ] L 6
2. 3845 mL = [ ] L [ ] mL 845
3. 2050 mL = [ ] L [ ] mL 2, 50
4. 6 L 325 mL = [ ] mL 6325
5. 4 L 600 mL = [ ] mL 4600
6. 4 L = [ ] mL 4000
7. 1500 mL = [ ] L [ ] mL 1, 500
8. 4000 mL = [ ] L 4
9. 3 L 75 mL = [ ] mL 3075
10. 5005 mL = [ ] L [ ] mL 5, 5

Solve.

11. A milk pouch holds 1333 mL. A new pouch is opened and used for the rice pudding recipe above. How much milk will be left in the pouch? 83 mL
12. How much milk is needed for a double recipe of rice pudding? 2500 mL
*13. About how much pudding is there for serving after using the recipe above? 1350 mL

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LESSON ACTIVITY

Using the Page

- The worked example presents an everyday situation that necessitates relating litres and millilitres. Read the statements to introduce the problem. Have students suggest how they would answer the question. Compare their suggestions with the solution shown beneath the recipe. Emphasize the relation 1000 mL = 1 L.

  Have students read the remaining ingredients of the recipe aloud and tell whether each amount is less than or more than 1 L.

Working Together: In Ex. 1 and 2, students associate a whole number of litres with multiples of 1000 mL (and vice versa). This relationship is applied in Ex. 3 and 4 for other amounts greater than 1 L, the steps of the procedure being provided. These steps may be followed in completing Ex. 5 and 6 and other similar exercises.

Exercises: Ensure that the students show the greatest number of litres (as suggested by Ex. 2) rather than writing answers such as 1 L 1050 mL for Ex. 3, for example. Ex. 13 can motivate a discussion. Some students may add the amounts for the ingredients listed to obtain 1855 mL. Others may find the product of 6 and 225 to obtain 1350 mL as the amount of pudding. Have students give reasons for their answers and provide an opportunity for them to share their opinions.

Assessment

Complete.

1. 3 L = 3000 mL
2. 4000 mL = 4 L
3. 2 L 25 mL = 2025 mL
4. 5650 mL = 5 L 650 mL

Solve.

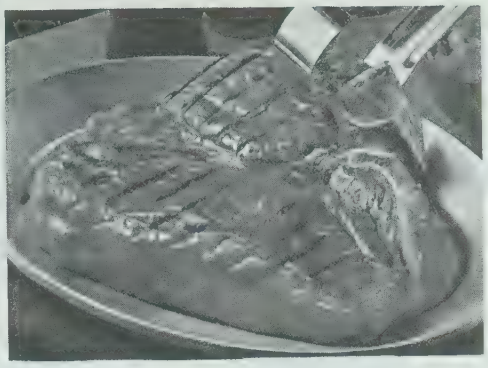
5. One bottle holds 750 mL of ginger ale. How much will bottles hold? 2250 mL or 2L 250 mL

Grams and Kilograms

One cookbook says there can be four servings from 1 kg of steak.

If a steak has a mass of 1125 g, is there enough for four servings?

For four servings, 1 kg, or 1000 g, is needed. If a steak has a mass of 1125 g, there is more than enough for four servings.



Working Together

Complete.

1. 3000 g = [ ] kg 3
2. 2 kg = [ ] g 2000
3. 1420 g =
   1000 g and [ ] g more. 420
   1420 g = [ ] kg [ ] g 1, 420
4. 3 kg 375 g =
   [ ] g and 375 g more. 3000
   3 kg 375 g = [ ] g 3375
5. 3925 g = [ ] kg [ ] g 3, 925
6. 4 kg 750 g = [ ] g 4750

Exercises

Complete.

1. 5000 g = [ ] kg 5
2. 3870 g = [ ] kg [ ] g 870
3. 4006 g = [ ] kg [ ] g 4, 6
4. 2 kg 575 g = [ ] g 2575
5. 1 kg 720 g = [ ] g 1720
6. 7000 g = [ ] kg 7
7. 5 kg 500 g = [ ] g 5500
8. 2 kg 2 g = [ ] g 2002
9. 6 kg = [ ] g 6000
10. 2075 g = [ ] kg [ ] g 2, 75

Solve.

11. An uncooked roast had a mass of 3 kg. After cooking, its mass was 2 kg 785 g. How much did the roast lose in cooking? 215 g

*12. If a steak with a mass of 1 kg gives 4 servings, about how many grams will be in each serving? 250

*13. 2000 g of pork and 4000 g of beef were ground up. How many kilograms of ground beef were there? 4

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Page 287

LESSON OUTCOME

Express grams as kilograms and grams, and kilograms as grams; solve related word problems

RELATED ACTIVITIES

- Have students find the mass of objects heavier than 1 kg, using appropriate scales, and show the mass two ways, for example,
  can of paint: 1 kg 350 g 1350 g
- Some students may be interested in determining the following information for a particular cut of meat, for instance, a steak.

Mass of uncooked steak _____

Mass of cooked steak _____

Mass lost in cooking process _____

Mass of leftover bone, gristle, fat, and so on _____

Mass of edible portion _____

LESSON ACTIVITY

Using the Page

- The situation presented in the example necessitates relating grams and kilograms. Read the statements with the students. Emphasize that since 1 kg is equal to 1000 g, 1125 g is more than enough for four servings. Ask the students how much more 1125 g is than 1 kg. Show the subtraction on the board. Write the sentence

  1125 g = 1 kg 125 g.

Working Together: The students first express a whole number of kilograms as a multiple of 1000 g (Ex. 1 and 2). This skill is applied in relating other amounts greater than 1 kg. The steps of the procedure are outlined in Ex. 3 and 4 and may be followed in completing Ex. 5 and 6.

Exercises: Although Ex. 12 implies division with a four-digit dividend, students will likely be able to arrive at an answer without writing a division exercise. It is implied that all four servings have the same mass. Students will need to read Ex. 13 carefully since not all the given information is relevant.

Assessment

Complete.

1. 4000 g = 4 kg
2. 8 kg = 8000 g
3. 3450 g = 3 kg 450 g
4. 6 kg 40 g = 6040 g

Solve.

5. An uncooked roast has a mass of 4 kg. The butcher says the roast will lose a mass of about 225 g in the cooking. What will be the mass of the cooked roast? 3775 g or 3 kg 775 g

Pages 288-289

LESSON OUTCOME

Draw bar graphs to represent sets of data

Materials

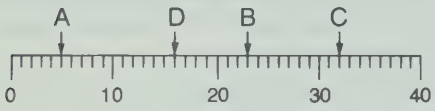
copies of page T 368 and a ruler for each student

Prerequisite Skills

Read a scale

Checking Prerequisite Skills

For this scale,

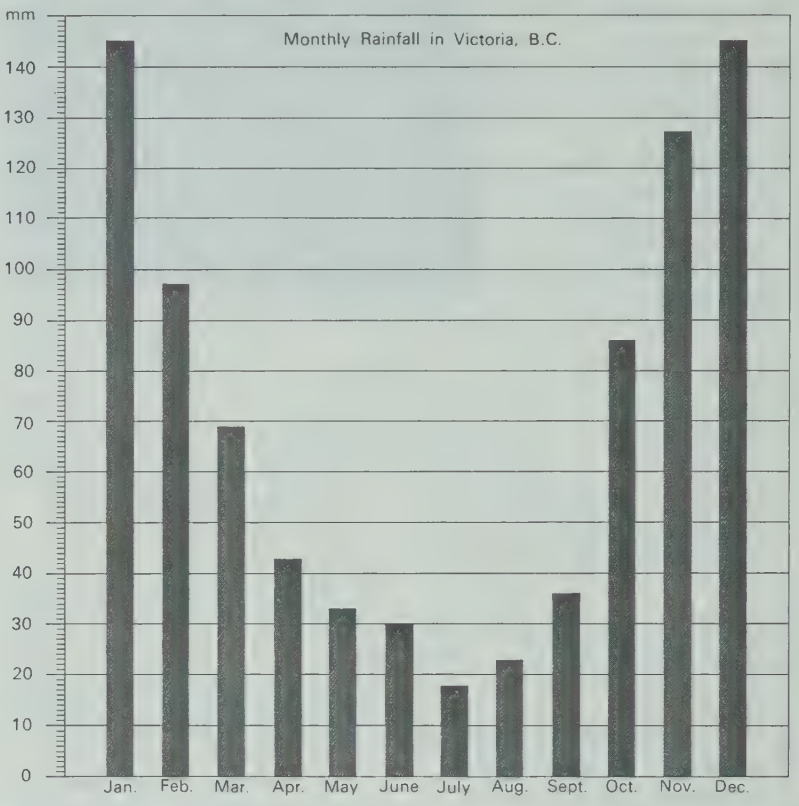


1. what point matches 23? B
2. what point matches 5? A
3. what number does point D name? 16

Working with Graphs

The graph shows how much rain fell each month in Victoria one year.

Rainfall is measured in millimetres.



Working Together

1. Which month had the least rainfall? July
2. Which months had the same amount of rain? January December
3. Which month had more rain, February or October? February
   How much more? 11 mm
4. About how much rain fell in July and August together? 41 mm
   in June, July, and August? 71 mm

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LESSON ACTIVITY

Using the Pages

- Have the students study the graph on page 288, and then ask them questions about the graph. Have them identify the diagram as a graph, in particular, a bar graph. Ask what the graph shows and discuss such aspects as the title, the vertical scale, and the headings across the bottom of the graph. Review that information displayed in a graph is often much easier to interpret than if the facts are merely written in a list. Also, this particular graph gives a visual impression of the amount of rain that fell each month, since the scale is in millimetre intervals.

Working Together: The exercises deal with the skill of interpreting a graph. Other similar exercises may be provided. The students will find it helpful to align the top of a bar with the scale, using a ruler to read the number of millimetres.

Exercises: Provide the students with copies of page T 368 on which to draw their graphs. They may write their question beneath the graphs. Assistance is provided for preparing th graph for Ex. 1. Discuss such aspects as the title, othe necessary headings, and the scale. Emphasize neatness an accuracy, and appropriate spacing of bars.

Problem Solving: This problem is an exercise in logica thinking and can challenge the students. Some may drav diagrams to help find a solution. Others may use objects t represent the situation and manipulate them to arrive at solution.

Assessment

1. Draw a graph for this information.
   Then write four questions that can be asked about the graph

February Snowfall			
Victoria	25 mm	Quebec	260 mm
Edmonton	110 mm	Fredericton	225 mm
Regina	85 mm	Halifax	130 mm
Winnipeg	95 mm	Charlottetown	235 mm
Toronto	120 mm	St. John's	250 mm

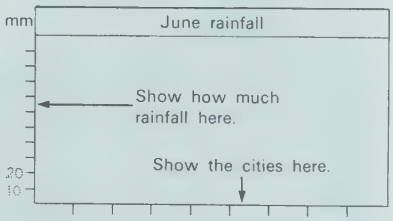
Exercises

Draw a graph for the information in each exercise.
Write four questions that can be asked about each graph. Answers will vary

1. June rainfall:

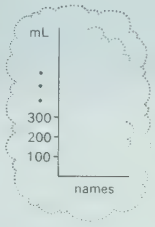
Calgary	90 mm
Churchill	40 mm
Ottawa	70 mm
Quebec	100 mm
Saskatoon	55 mm
Vancouver	45 mm
Victoria	30 mm
Yellowknife	15 mm

Prepare your graph paper like this:



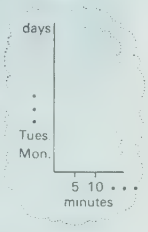
2. Milk drank yesterday:

Axel	1250 mL
Betsy	800 mL
Ellie	800 mL
Amy	250 mL
Herb	1750 mL
Jan	1000 mL
Marvin	1500 mL

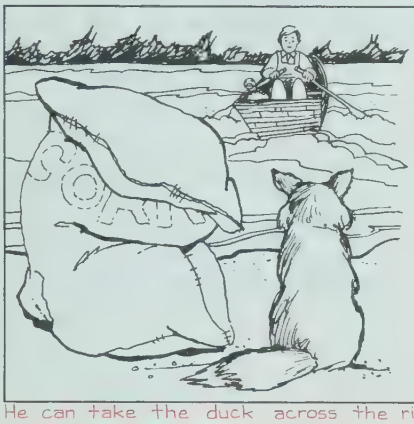


3. Joshua's piano practice:

Monday	35 min
Tuesday	30 min
Wednesday	25 min
Thursday	45 min
Friday	30 min
Saturday	15 min
Sunday	5 min



Graphs for Ex. 1-3 are given below



The man has to move the fox, the duck, and the bag of corn across a river in a boat.

He can carry only one at a time in the boat. He cannot leave the duck alone with the corn, and it would be too dangerous to leave the fox alone with the duck.

How can the man get the fox, the duck, and the corn across the river?

PROBLEM SOLVING

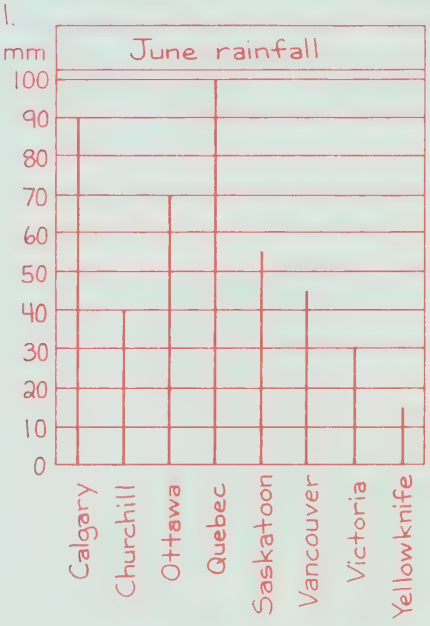
He can take the duck across the river and leave it there. He can come back and get the corn, take it across the river, and bring the duck back with him. He can leave the duck and take the fox across the river. Then he can come back and take the duck across the river.

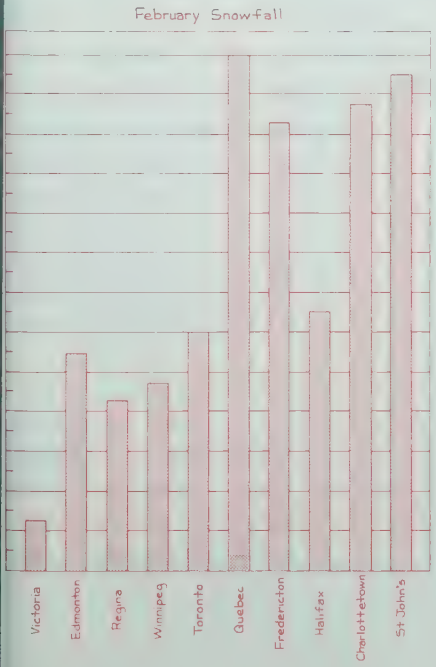
RELATED ACTIVITIES

- Have students search magazines and newspapers for examples of bar graphs, particularly those that show rainfall in millimetres. These may be displayed. Students may write questions that can be asked about the graphs for other students to answer.
- Have students research the average annual rainfall for different parts of the world. If colored tape is used for bars of a graph (a different color for each country), the graph can be shown on a concrete wall. The tape may be fastened to the wall so that the base of the graph is the floor of the room. This will give students a clear impression of the amount of rainfall.

Page 289 Exercises

1.





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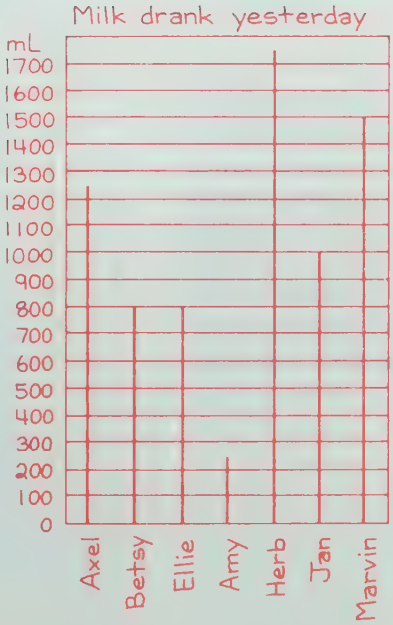

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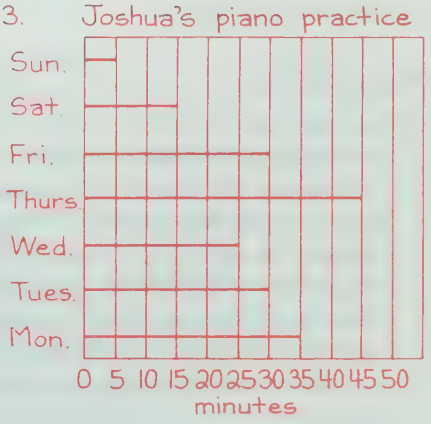


Page 290

OBJECTIVE

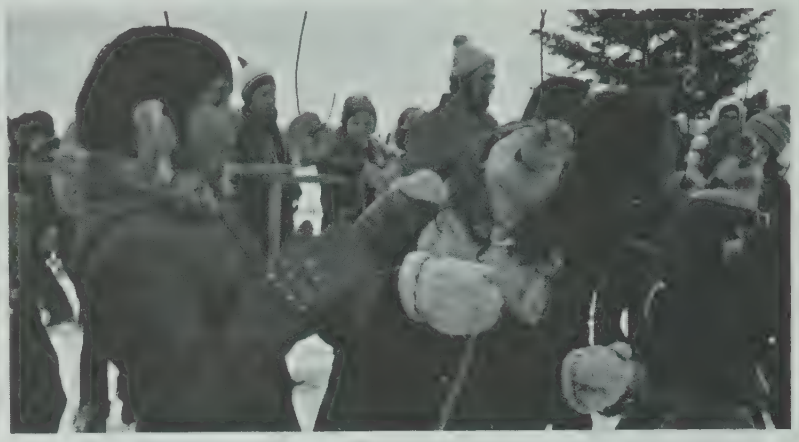
Estimate answers to problems, using a variety of informal methods

RELATED ACTIVITIES

- Some students may be interested in carrying out experiments for the examples in Ex. 3 and 4. If they count the number of blinks in five or ten seconds, for example, they may use multiplication to estimate the number of times they would blink in one hour. Similarly, for Ex. 4, they may count the words in one line and multiply by the number of lines.
- Have students suggest other situations, similar to those described on the page, which they have encountered personally. Have them tell how they estimated the answer.

Estimating Answers

How many seconds do you think you would need . . .



. . . to take a bite from a doughnut?
. . . to eat the whole doughnut?

Tell how you would estimate

Answers will vary

1. the amount of string you should cut from a ball to tie a box.
2. the amount of money you need when you go shopping.
3. how many times you blink in an hour.
4. the number of words on one page of a storybook.

What signs help you estimate

5. the temperature outside when you are inside?
6. the time of day?
7. if a friend has a fever?
8. how long it will take to dry the dishes?
9. how hot a stove burner is?
10. water temperature?

PROBLEM SOLVING

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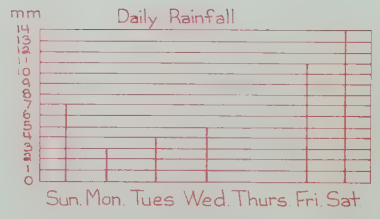
LESSON ACTIVITY

Using the Page

- These exercises describe situations or tasks for which students are asked to estimate answers. The word *estimate* is used in a broad, everyday sense rather than in the strict, mathematical sense. In some instances, the problems do not involve numbers, for example, Ex. 7. The situations suggested in these exercises are of the kind that students have likely encountered at one time or another. The exercises are probably best suited to discussions conducted in small groups, to enable each student to contribute to the discussion.

Page 291 24.



Checking Up

Do you measure length, mass, capacity, or time to find

1. how light an eraser is? mass
2. how quickly you can erase a word? time
3. how thick the eraser is? length

Choose the best estimate for

4. the mass of a marshmallow. → 1 g | 500 g | 1 kg
5. the width of a safety pin. → 1 mm | 1 cm | 1 m
6. the capacity of a pop can. → 1 mL | 500 mL | 1 L
7. how long a TV program lasts. → 1 s | 1 min | 1 h
8. breakfast time. → 4:30 a.m. | 7:45 a.m. | 8:10 p.m.
9. supper time. → 06:10 | 11:15 | 17:45

Choose the unit that best completes each sentence.

mm	cm	m	km
g	kg	mL	L
s	min	h	d

10. A bag of potatoes has a mass of about 10 kg?.
11. It takes about 3 s ? to pour a glass of milk.
12. A raisin is about 12 mm? long.
13. A teakettle holds about 3 L ?.
14. The mass of a golf ball is about 44 g ?.
15. A drinking straw holds about 4 mL?.
16. A bath takes about 10 min?.
17. The room is about 4 m ? wide.

Complete.

18.

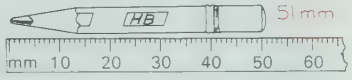
12-hour clock	2:16 a.m.	? (1:10 p.m.)	9:18 p.m.
24-hour clock	? (02:16)	13:10	? (21:18)

19. 28 d = weeks 4
20. 3 h 20 min = min 200

What time is it when it is

21. 3 h 15 min later than 10:30? 13:45 or 1:45 p.m.
22. 5 h 30 min earlier than 2:30 p.m.? 9:00 a.m.

Give the length in millimetres.

23. 

51 mm

Show this information in a graph.

24. Daily rainfall: Sunday 7 mm, Monday 3 mm, Tuesday 4 mm, Wednesday 5 mm, Thursday 0 mm, Friday 11 mm, Saturday 14 mm

Complete.

25. 1 L 325 mL = mL 1325
26. 2047 mL = L mL 2, 47
27. 2 kg 37 g = g 2037
28. 3624 g = kg g 3, 624

Skills	Exercises	Related Pages
Demonstrate an understanding of length, capacity, mass, and time	1-3	T 294-T 297
Estimate length	5	T 302, T 303
Estimate mass	4	T 306-T 307
Estimate capacity	6	T 304-T 305
Estimate time	7-9	T 298-T 301
Select units of measurement	10-17	T 298-T 299 T 302-T 307
Relate times	18-20	T 298-T 301
Add, subtract times	21, 22	T 300-T 301
Give length in millimetres	23	T 302
Draw a bar graph	24	T 310-T 311
Relate litres and millilitres	25, 26	T 308
Relate kilograms and grams	27, 28	T 309

OBJECTIVE

Demonstrate an understanding of the concepts and skills presented in this unit

Materials

a copy of page T 368 and a ruler for each student

RELATED ACTIVITIES

• A summary of the various units would be appropriate at this time. Have students help to prepare these lists. Compare the prefixes used in naming the units and the relationships among the units.

Length can be measured in	
kilometres	km

1 km	=	1000	m
1 m	=	10	dm
	=	100	cm
	=	1000	mm

Capacity can be measured in	
litres	L

Mass can be measured in	
kilograms	kg

Time can be measured in	
seconds	s

Comments

Provide students with a copy of page T 368 on which to draw the graph for Ex. 24. Have them use their rulers in drawing lines on the graph.

Note that for Ex. 10-17, students first must decide what kind of measurement is involved and then select the appropriate unit. For example, Ex. 13 involves capacity (not length, mass, or time) and the best unit in this case is the litre. Students having difficulty with these may need further work with exercises similar to Ex. 1-3 on this page and Ex. 9-16 on page 275.

An understanding of different kinds of measurement and different units of measure is probably best promoted through many activities in measuring objects.

Pages 292-293

OBJECTIVE

Demonstrate competence in addition, subtraction, multiplication, and division skills; solve related word problems

Checking Skills

Add.

1. 427 + 127 = 554	2. 26.3 + 9.3 = 35.6	3. 1.74 + 4.53 = 6.27
4. 1786 + 822 = 2608	5. 6.3 + 3.8 = 10.1	6. $3.48 + 4.64 = $8.12
7. $659 + 683 = $1342	8. 28.5 + 56.5 = 85.0	9. 53.91 + 61.76 = 115.67
10. 1973 + 2213 + 647 = 4833	11. 8.2 + 19.6 + 7.5 = 35.3	12. $11.28 + 7.36 + 4.57 = $23.21
13. 541 + 1313 + 90 + 232 = 2176	14. 13.2 + 4.4 + 0.6 + 21.5 = 39.7	15. $38.27 + 4.38 + 27.67 + 42.09 = $112.41

Subtract.

16. 418 − 194 = 224	17. 7.2 − 2.3 = 4.9	18. 4.33 − 2.70 = 1.63
19. $187 − 98 = $ 89	20. 62.4 − 38.7 = 23.7	21. $7.34 − 5.56 = $1.78
22. 5602 − 4934 = 668	23. 11.1 − 3.2 = 7.9	24. $62.48 − 24.89 = $37.59
25. 3136 − 244 = 2892	26. 45.0 − 10.7 = 34.3	27. $4.24 − 3.79 = $0.45
28. $3000 − 1216 = $1784	29. 8.6 − 5.8 = 2.8	30. 70.37 − 15.66 = 54.71
31. 1018 − 963 = 55	32. 97.5 − 27.8 = 69.7	33. $23.44 − 6.95 = $16.49

Multiply.

1. 43 × 2 = 86	2. 322 × 3 = 966	3. 112 × 4 = 448
4. 131 × 3 = 393	5. 23 × 4 = 92	6. 374 × 2 = 748
7. 218 × 6 = 1308	8. 132 × 5 = 660	9. $685 × 2 = $1370
10. 584 × 7 = 4088	11. 87 × 5 = 435	12. $384 × 8 = $3072
13. $6.02 × 8 = $48.16	14. $4.72 × 7 = $33.04	15. $7.95 × 3 = $23.85
16. 5.3 × 9 = 47.7	17. 7.4 × 6 = 44.4	18. 2.8 × 9 = 25.2
19. 67 × 20 = 1340	20. 59 × 26 = 1534	21. 645 × 59 = 38 055
22. 571 × 44 = 25 124	23. 38 × 17 = 646	24. $418 × 30 = $12 540
25. 726 × 51 = 37 026	26. 946 × 39 = 36 894	27. $38 × 28 = $1064
28. $3.19 × 50 = $159.50	29. $6.49 × 37 = $240.13	30. $4.86 × 41 = $199.26

Tickets cost $2.75 for an adult and $1.25 for a child.

31. How much will 5 adult tickets cost? $13.75

32. How much will tickets cost for 12 children? $15.00

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LESSON ACTIVITY

Using the Pages

- The exercises are arranged in four sections on these two pages and present the skills as follows.

Section 1: Addition and Subtraction

The exercises are grouped according to operation. Both groups are arranged so that the first column concerns whole numbers, the second column concerns decimal tenths, and the third column concerns decimal hundredths and amounts of money. In general, they are arranged in increasing order of difficulty as to the number of regroupings required.

Section 2: Multiplication

One-digit multipliers are dealt with first, and these are followed by exercises with two-digit multipliers. Multiplication of decimal tenths is included in Ex. 16-18. The section ends with two related word problems.

Section 3: Division

These exercises progress from basic facts (Ex. 1-6) extensions of basic facts (Ex. 7-12), and from these division with a remainder of zero (Ex. 13-33) and w remainders greater than zero (Ex. 34-51). Two related wo problems conclude this section.

Section 4: Word Problems

The problems are not grouped according to operation. T students will need to give careful consideration to ea problem to determine what operation is necessary to sol it. Remind them to write a concluding statement for ea problem.

In working through the exercises on these pag students review the major skills in addition, subtracti multiplication, and division that were encountered previous units. You may wish to have them complete c section at a time, or you may assign several exercises fr each section to be completed together.

Divide.

1. $3\overline{)9}$ 3	2. $6\overline{)24}$ 4	3. $3\overline{)21}$ 7
4. $5\overline{)30}$ 6	5. $4\overline{)32}$ 8	6. $6\overline{)\$54}$ \$9
7. $9\overline{)450}$ 50	8. $2\overline{)120}$ 60	9. $8\overline{)560}$ 70
10. $4\overline{)800}$ 200	11. $7\overline{)280}$ 40	12. $5\overline{)\$450}$ \$90
13. $3\overline{)96}$ 32	14. $6\overline{)246}$ 41	15. $4\overline{)168}$ 42
16. $5\overline{)565}$ 113	17. $2\overline{)824}$ 412	18. $7\overline{)\$427}$ \$61
19. $3\overline{)495}$ 165	20. $2\overline{)796}$ 398	21. $7\overline{)371}$ 53
22. $8\overline{)384}$ 48	23. $5\overline{)85}$ 17	24. $4\overline{)68}$ 17
25. $2\overline{)110}$ 55	26. $2\overline{)548}$ 274	27. $5\overline{)\$215}$ \$43
28. $9\overline{)243}$ 27	29. $3\overline{)882}$ 294	30. $7\overline{)539}$ 77
31. $4\overline{)260}$ 65	32. $9\overline{)756}$ 84	33. $5\overline{)\$410}$ \$82
34. $9\overline{)75}$ 8 R3	35. $2\overline{)367}$ 183 R1	36. $4\overline{)110}$ 27 R2
37. $8\overline{)286}$ 35 R6	38. $7\overline{)636}$ 90 R6	39. $6\overline{)338}$ 56 R2
40. $6\overline{)810}$ 135	41. $3\overline{)949}$ 316 R1	42. $8\overline{)771}$ 96 R3
43. $7\overline{)600}$ 85 R5	44. $8\overline{)502}$ 62 R6	45. $9\overline{)\$387}$ \$43
46. $3\overline{)220}$ 73 R1	47. $8\overline{)932}$ 116 R4	48. $6\overline{)524}$ 87 R2
49. $9\overline{)871}$ 96 R7	50. $6\overline{)683}$ 113 R5	51. $5\overline{)254}$ 50 R4

308 children were placed in 4 groups for fall sports.

52. How many were in each group? 77

53. The children were placed in 7 groups for spring sports. How many were in each group? 44

Solve.

1. A wrist radio costs \$7.95. Batteries for it cost \$1.29. How much do the radio and the batteries cost in all? \$9.24
2. The dentist's bill was \$72 for the 4 Burdette children. The fee was the same for each child. What was the dentist's fee for each child? \$18
3. The 10-speed bicycle costs \$112. The one-speed bicycle costs \$58. How much more does the 10-speed bicycle cost? \$54
4. Sandra bought 6 boxes of nails. There are 288 nails in each box. How many nails did she buy? 1728
5. Each box of nails costs \$1.79. How much do 6 boxes cost? \$10.74
6. The names of 507 students are listed in 3 columns. There are the same number of names in each column. How many names are in each column? 169
7. The Miller family plans to take a holiday trip of 1675 km and another of 768 km. How many kilometres are they planning to travel in all? 2443
8. The garden centre ordered 15 bags of seed. Each bag holds 25 kg. How many kilograms of seed did it order? 375
9. 8 buttons are on each card. Mr. Tailor needs 140 buttons. How many cards should he buy? 18

RELATED ACTIVITIES

- Choose from related activities and games in preceding units for review and enrichment.

Unit 13 Overview

Fractions and Decimals

In this unit, simple fractions showing halves, fourths, and tenths are explored, both by themselves and as they are related to equivalent decimals. Real objects, models, number lines, and money are used to show the meaning of the fractions. Equivalent fractions for one-half are studied in terms of fourths and tenths. Fraction names for 1 are considered. Decimal equivalents to two places are presented for halves, fourths, and tenths. Adding and subtracting fractions and mixed numbers with like denominators (halves, fourths, tenths) is paralleled with performing these operations using equivalent decimals. Decimals also point out the similarities and differences when the processes involve renaming sums and minuends involving fractions. The *Try This* feature shows how to make a pattern using a grid. The problem-solving skill presented in the final lesson is the use of common sense to determine whether a statement is true or false. In another place, students are presented with problem situations where a remainder of one can be shared in some instances and not shared in others. This emphasizes further the need for using common sense in solving everyday problems.

Prerequisite Skills

- write numerals for fractions less than 1 (halves, fourths, tenths)
- write numerals for decimals (tenths, hundredths)
- use dollars-and-cents notation to write amounts of money
- match points on a number line with fractions or decimals
- compare and order decimals
- add and subtract decimals

Unit Outcomes

- recall numerals for fractions less than 1 and mixed numbers less than 10 for halves, fourths, and tenths
- identify and use $\frac{1}{2}$, $\frac{2}{4}$, and $\frac{5}{10}$ as equivalent fractions
- identify and use $\frac{1}{2}$, 0.5, and 0.50 as equivalents
- relate fourths, quarters, and decimal amounts of money
- identify and use equivalent fractions and decimals for halves, fourths, tenths, and hundredths
- compare and order fractions less than 1 (halves, fourths, tenths, hundredths) using decimal equivalents
- identify and use equivalent-fraction names for 1
- add two proper or mixed-form fractions with equal denominators for halves, fourths, and tenths (fraction parts having a sum less than or equal to 1)
- subtract proper or mixed-form fractions with equal denominators for halves, fourths, and tenths (whole-number minuends or minuends with fractions greater than or equal to fractions in the subtrahend)
- place the decimal point in a numeral so that a statement makes sense

Background

The adoption of the metric system of measurement requires more emphasis on decimal notation and on fraction concepts associated with tenths and hundredths. At the same time, less attention is needed on other fractions and operations with them since they are utilized less frequently in a metric and decimal era. Nevertheless, there will continue to be situations in whic simple fractions are the major type of representation. Fo instance, one-fourth, one-half, and three-fourths will continue t represent certain parts of an hour, and although capacities an quantities less than one litre will frequently be expressed i millilitres, there will be occasions to use one-half litre — at lea in conversation, if not in mathematics.

There are many different representations for any number, an this applies to fractions as well as to whole numbers. Th number six, for example, can be represented by $4 + 2$, $2 \times$ $2 + 2 + 2$, $10 - 4$, $48 \div 8$, and many other number expre sions because they are all equivalent. Similarly, the fractio concept "one-half" can be represented by $\frac{1}{2}$, $\frac{2}{4}$, $\frac{5}{10}$, and $\frac{50}{10}$ because they are equivalent. The form in which a number fraction is considered and used depends on a variety of factor chief of which are context and convenience. For example, it easy to think of one-half metre in terms of centimetres and visualize $\frac{50}{100}$ as a meaningful representation. In some instanc it may be more convenient to represent one-half metre as decimal (0.5 m), particularly if any mathematical computatio is to be made. It is important, therefore, for one to be aware equivalents for fractions, both in fractional forms and decimals, so that the best form can be utilized at any one time

Comparison of fractions is difficult since both the numerato and the denominators must be taken into consideration. Throug experience with models and number lines, students shou acquire the understanding that a greater denominator indicates smaller unit part, and that, for the same object or numbe fourths are smaller than halves, and tenths are smaller tha fourths. It is rather difficult, however, to know whether $\frac{3}{4}$ greater than or less than $\frac{4}{5}$ of the same whole, since there are fo variables to be considered simultaneously. Decimal equivalen for fractions make comparison a relatively easy matter sin denominators are eliminated. Since $\frac{3}{4} = 0.75$ and $\frac{4}{5} = 0.80$, quick glance at the decimals reveals that 0.80 is greater tha 0.75, and thus $\frac{4}{5}$ is greater than $\frac{7}{10}$. Similarly, $\frac{3}{4} = 0.75$ a $\frac{7}{10} = 0.7$ or 0.70; since 0.75 is greater than 0.70, then $\frac{3}{4}$ greater than $\frac{7}{10}$.

In the strictest sense of the word, "decimals" usually refers the numerals for decimal fractions, for example, 0.7 and 3. Similarly, "fractions" usually refers to the numerals f fractional numbers, for example, $\frac{9}{10}$ and $3\frac{3}{4}$. For simplicity this series, the words "decimals" and "fractions" are us when speaking of the numbers as well as the numerals.

This unit presents the addition and subtraction of fractions another way of writing additions and subtractions that have be learned previously; namely, addition and subtraction of dec mals. The addition $\frac{6}{10} + \frac{3}{10} = \frac{9}{10}$ is seen as another way writing the addition $0.6 + 0.3 = 0.9$, and the addition $1\frac{1}{2} +$ can be related to $1.5 + 3.0$. Similarly, $3\frac{7}{10} - 1\frac{4}{10} = 2\frac{3}{10}$ seen as another way of writing $3.7 - 1.4 = 2.3$, and $4 -$ can be related to $4.0 - 2.5$. These concepts are furth facilitated by the use of similar models as were encountered the introduction of decimals. The same whole is seen divid into halves, fourths, tenths, and hundredths (see *Teachi Strategies*).

There are several different types of real-life situations which remainders from division are treated differently. Studer need to know both the how and the why of three methods dealing with them:

the remainder is ignored;
the remainder is recorded as a whole number, as a decimal, or as a fraction of the divisor;
the remainder suggests increasing the quotient by 1.

The following examples illustrate the three situations.

A card game requires 4 players. 18 people have requested to play. How many groups can be formed?

$$4\overline{)18}\quad 4\text{ R}2,\ \text{remainder } 16,\ 2$$

Only 4 groups can be formed. Since 2 players cannot form a group, the remainder is ignored.

A price of $18 was paid for 4 m of cloth. What was the price per metre?

4 R2 is expressed as a decimal, 4.50. One metre of cloth costs $4.50.

On a ride at the fair, each car can hold 4 children. How many cars are needed for 18 children?

Although the division gives 4 R2, five cars are needed. The situation suggests increasing the quotient by 1.

In this unit the students are challenged with types similar to) and (2), and they have to decide whether there is a fair way sharing a remainder. If it can be shared, sometimes the mainder needs to be renamed and then divided; if it cannot be ared, it is ignored.

Sometimes foolish errors are made by placing decimal points the wrong places. A recent sale advertisement in a newspaper fered braid at 0.05¢ a metre. Obviously, five cents (5¢, $0.05) as intended but certainly not five-hundredths of a cent. The cimal point can be moved so easily, but it cannot be treated htly. Moving it to the right or to the left one place may seem be a trivial matter, but the number is either 10 times the tended size or one-tenth the intended size. The single lesson in is unit can do no more than open students' minds to the need r examining statements critically for accuracy.

eaching Strategies

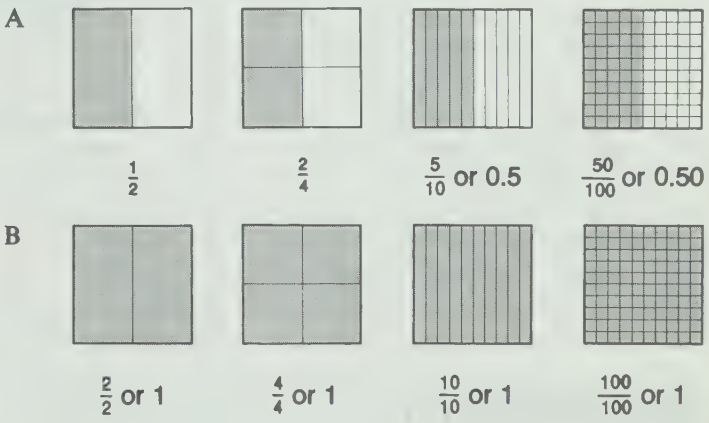
If this unit on fractions and decimals goes beyond the basic ogram for your class or some of the students in your class, ldditional work with number operations should be arranged. ets of exercises similar to those at the end of Unit 12 may be sed to identify particular weaknesses and to prepare related ractice exercises. A complete description of the various types f skills involved is given on pages T 314 and T 315.

For this unit, a mathematics center is recommended so that udents may be able to compare models of wholes, tenths, and undredths with models of halves and fourths. A description for reparing suitable models is given below. For relating tenths and undredths with halves and fourths, give students the opportu- ity to color diagrams of tenths and hundredths as described elow. Games such as the one described on page 301 of the text nd on page T 325 require sets of cards showing proper fractions nd decimals less than 1. Sets of these cards can be placed in the athematics center along with dominoes (see page T 323) and ther models of fractions and decimals which are suggested in ne lesson outlines. Students can use these at different times roughout the day and informally learn fraction and decimal quivalents and the comparative sizes of the numbers they epresent.

It is desirable to intersperse maintenance exercises among the essons of the unit. Students should also be directed to spend time on their individual needs in the four basic number operations and try to achieve complete mastery of the basic facts and operations. For this purpose, they may redo specified exercises in earlier units. It is also suggested that exercises from old textbooks or workbooks be placed on cards and sorted into five sets (addition, subtraction, multiplication, division, and mixed exercises) with cards in each set numbered consecutively to indicate increasing levels of difficulty. Students can work their way through the sets and check their own or one another's answers from answer keys.

Models for Halves, Fourths, Tenths, and Hundredths

On page T 187 of the Overview for Unit 8, a description is given for preparing models of wholes, tenths, and hundredths. Copies of pages T 364 and T 365 are suggested for this purpose. In this unit, halves and fourths are related to equivalent tenths and hundredths, for example, $\frac{3}{4} = 0.75$. To facilitate this, models for halves and fourths may be prepared using copies of the decimetre squares on pages T 363, T 364, and T 365. The squares may be marked into halves and fourths, facilitated, if necessary, by folding and then unfolding the squares appropriately. They may then be colored to show one half, two halves, and from one fourth to four fourths, respectively. Coloring models of tenths and hundredths to show halves and fourths helps in comparing fractions and decimals (A), and in naming equivalent fractions for the number one (B). Using the decimetre square as the whole enables students to see the same whole divided into two, four, ten, or one hundred equal parts.



Materials

a paper strip 20 cm by 20 cm for each student (some of the strips should be marked to show tenths)
copies of pages T 363, T 364, and T 365
play money or cutouts from pages T 351 and T 352 (dollars, quarters)
models for ones, tenths, and hundredths (optional)
tracing paper for each student
models for halves, fourths, tenths, and wholes as described above

Vocabulary

equivalent fractions

Page 294

OBJECTIVE

Recall numerals for fractions less than 1 and mixed numbers less than 10 for halves, fourths, and tenths

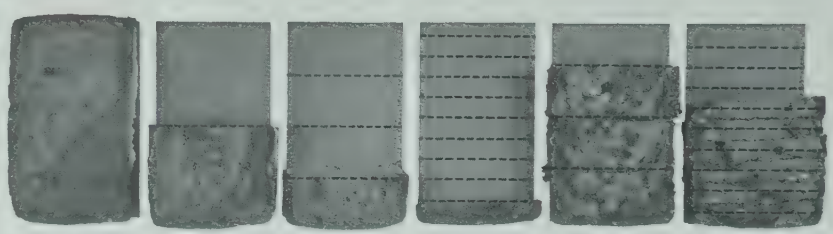
RELATED ACTIVITIES

- Have the students write a fraction to show how much cake has been eaten for each of the cakes shown on page 294. Have them write a fraction to show how much is not shaded for Ex. 1-6.
- You may wish to ask questions about the photograph of the cakes, such as,
"Which fraction names more cake, one-half or six-tenths?"
"Which fraction names more cake, six-tenths or three-fourths?"
- You may wish to have students study the photograph of the cakes and discuss that one whole cake is the same amount as two halves, four fourths, or ten tenths.

13 FRACTIONS AND DECIMALS

Practice with Halves, Fourths, and Tenths

Ricky cut the cakes to show fractions.



1 $\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{10}$ $\frac{3}{4}$ $\frac{6}{10}$

Exercises

Use a fraction to show how much is shaded.

1. $\frac{4}{10}$
2. $\frac{1}{4}$
3. $\frac{7}{10}$
4. $1\frac{1}{2}$
5. $2\frac{3}{4}$
6. $1\frac{3}{10}$

7–11 Shapes will vary.

Draw and shade to show each amount.

Example: For $1\frac{3}{4}$, draw

7. $1\frac{1}{4}$
8. $\frac{9}{10}$
9. $2\frac{1}{2}$
10. $\frac{2}{4}$
11. $1\frac{5}{10}$

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LESSON ACTIVITY

Using the Page

- Review the concept of halves, fourths, and tenths as parts of a whole by discussing the cakes in the photograph. Many students are familiar with cutting a cake into equal portions. Review that the numeral 1 under the first cake represents one whole cake. Have students relate the other numerals to the corresponding parts of cakes. For example, the third cake shows one fourth because the whole cake was cut into four equal parts and only one of the four parts remains. Emphasize that the parts are equal. Review that the upper number in the fraction numeral names the number of equal parts shown, and the lower number names the size (the number) of the equal parts of the whole.

Exercises: Have a student explain to the other students how the fractions can be determined for Ex. 1-6. That is, it is necessary to count the blue equal parts and all the equal parts for each diagram. For Ex. 7-10, the students may draw shapes similar to those in Ex. 1-6.

Assessment

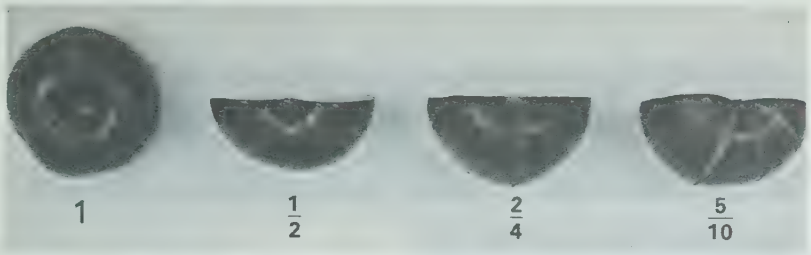
Use a fraction to show how much is shaded.

1. $\frac{3}{4}$
2. $1\frac{4}{10}$
3. $2\frac{1}{2}$

Draw shapes and shade to show each amount.

4. $1\frac{1}{4}$
5. $1\frac{3}{10}$

Equivalent Fractions for One-Half

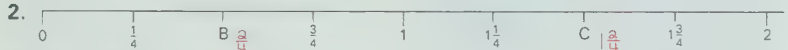


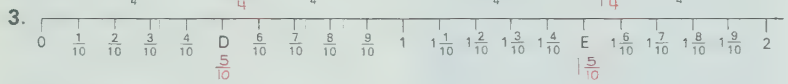
$\frac{1}{2}$, $\frac{2}{4}$, and $\frac{5}{10}$ all name the same amount.

Working Together

What numbers match the points marked with letters?

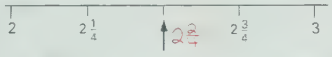
1.

2. 

3. 

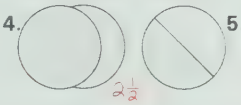
Exercises

Use $\frac{1}{2}$, $\frac{2}{4}$, or $\frac{5}{10}$ to write the numeral that matches each picture best.

1. 

2.

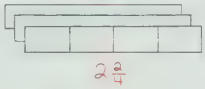
3.

4. 

5.

6.

7.

8. 

9.

10.

11.

LESSON OUTCOME

Identify and use $\frac{1}{2}$, $\frac{2}{4}$, and $\frac{5}{10}$ as equivalent fractions

Materials

a paper strip 20 cm by 2 cm for each student (some of the strips should be marked to show tenths)

Vocabulary

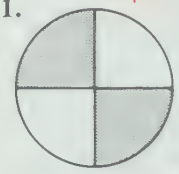
equivalent fractions

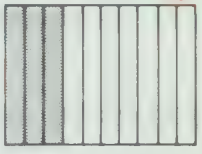
Prerequisite Skills

Write numerals for fractions less than 1 (halves, fourths, tenths)

Checking Prerequisite Skills

Write a fraction to show how much is shaded.

1. 

2. 

RELATED ACTIVITIES

- Have students identify the pictures on page 294 that show one-half (see Ex. 4 and 5).
- Display for several days one of each kind of paper strip used in the preliminary activities. Also, show the corresponding fraction for each strip. Have students mark and color other shapes, for example, circular shapes, such as filter paper, to show halves.

ESSON ACTIVITY

efore Using the Page

Provide each student with a strip of paper 20 cm long and 2 cm wide. Have one group of students fold and mark their strips to show halves and color one half blue. Have another group fold and mark their strips to show fourths and color two fourths blue. Have a third group color five tenths blue on strips that you previously marked into tenths. Have the students compare their strips.

sing the Page

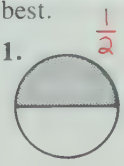
Discuss the photograph of the apples to reinforce that $\frac{1}{2}$, $\frac{2}{4}$, and $\frac{5}{10}$ name the same amount. For example, if the apple is cut into 10 equal parts, 5 of the 10 parts are needed to show one-half the apple. Draw attention to the term *equivalent fractions* in the title. Explain that equivalent fractions name the same number.

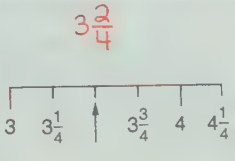
Working Together: Number lines of the same length are shown marked into halves, fourths, and tenths, respectively. The points which mark half the distance from 0 to 1 and from 1 to 2 can be named in three ways. Emphasize that points A, C, and E, for example, have the same position on the number line and thus the corresponding fractions name the same number.

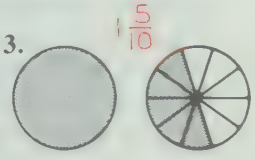
Exercises: Read the instructions and have a student interpret what is meant by "matches each picture best". That is, if the picture shows tenths as in Ex. 5, one-half the circular shape would be named as $\frac{5}{10}$. Emphasize that for Ex. 3-11, each picture involves one-half a whole.

Assessment

Use $\frac{1}{2}$, $\frac{2}{4}$, or $\frac{5}{10}$ to write the numeral that matches each picture best.

1. 

2. 

3. 

Page 296

LESSON OUTCOME

Identify and use $\frac{1}{2}$, 0.5, and 0.50 as equivalents

Materials

copies of pages T363, T364, and T365

Prerequisite Skills

Write numerals for decimals and fractions

Checking Prerequisite Skills

Write the fraction.

1. three and one-half $3\frac{1}{2}$
2. five and one-half $5\frac{1}{2}$

Write the decimal.

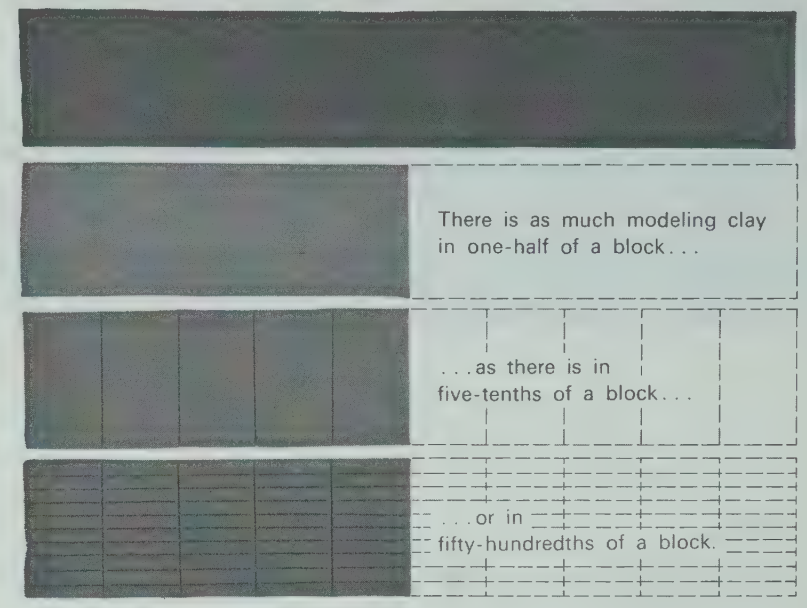
3. fifty-hundredths 0.50
4. seven and five-tenths 7.5

RELATED ACTIVITIES

- Students may benefit by completing charts similar to the following.

Halves	Tenths	Hundredths
$\frac{1}{2}$	0.5	0.50
$1\frac{1}{2}$	1.5	1.50
$2\frac{1}{2}$	2.5	2.50
$3\frac{1}{2}$	3.5	3.50
$9\frac{1}{2}$	9.5	9.50

Decimal Names for One-Half



$\frac{1}{2}$, 0.5, and 0.50 all name the same amount.

Exercises

Write each of these as a decimal showing tenths.

1. $\frac{1}{2}$ 0.5 **2.** 0.50 0.5 **3.** $2\frac{1}{2}$ 2.5 **4.** 4.50 4.5 **5.** $6\frac{1}{2}$ 6.5 **6.** $1\frac{1}{2}$ 1.5

Write each of these as a decimal showing hundredths.

7. $1\frac{1}{2}$ 1.50 **8.** $\frac{1}{2}$ 0.50 **9.** 7.5 7.50 **10.** $4\frac{1}{2}$ 4.50 **11.** 0.5 0.50 **12.** $3\frac{1}{2}$ 3.50

Write each of these using the fraction $\frac{1}{2}$.

13. 2.50 $2\frac{1}{2}$ **14.** 1.5 $1\frac{1}{2}$ **15.** 3.50 $3\frac{1}{2}$ **16.** 0.5 $\frac{1}{2}$ **17.** 5.5 $5\frac{1}{2}$ **18.** 0.50 $\frac{1}{2}$

296

LESSON ACTIVITY

Before Using the Page

- Have the students work in groups of three. For each group, instruct one student to color 50 hundredths of a decimetre square showing hundredths (see page T365). Have another student color 5 tenths of a decimetre square showing tenths (see page T364). Have the third student fold a decimetre square for wholes (see page T363) to show halves (not folded along a diagonal) and color one half. Have the students compare their results.

Using the Page

- The photographs of the modeling clay help to show that $\frac{1}{2}$, 0.5, and 0.50 all name the same amount. Ask which color of modeling clay shows halves, which shows tenths, and which shows hundredths. Have students give reasons for their answers. Emphasize that the numerals $\frac{1}{2}$, 0.5, and 0.50 are different, but they name the same amount and thus may be used interchangeably.

Exercises: Review the instructions with the students. You may wish to complete Ex. 1, 7, and 13 with the students to clarify their meanings.

Assessment

1. Write $4\frac{1}{2}$ as a decimal showing tenths. 4.5
2. Write $2\frac{1}{2}$ as a decimal showing hundredths. 2.50
3. Write 6.50 using the fraction $\frac{1}{2}$. 6.5
4. Write 1.5 using the fraction $\frac{1}{2}$. 1.5

Fourths and Quarters

The value of 25 pennies is the same as the value of 1 quarter.

$0.25

$0.25

This is called a **quarter** because its value is one-fourth the value of a dollar.

0.25 and $\frac{1}{4}$ each name the same amount.

Working Together

Complete each chart.

	Number of quarters	Fraction of a dollar	Value
1.	1	$\frac{1}{4}$	$0.25
2.	2	$\frac{2}{4}$	$0.50
3.	3	$\frac{3}{4}$	$0.75

	Decimal	Fraction
4.	0.25	$\frac{1}{4}$
5.	0.50	$\frac{2}{4}$
6.	0.75	$\frac{3}{4}$
7.	1.25	$1\frac{1}{4}$

Exercises

Copy and complete each chart.

	Bills and coins	Value
1.	1 dollar and 3 quarters	$1.75
2.	2 dollars and 1 quarter	$2.25
3.	2 quarters	$0.50
4.	3 dollars and 3 quarters	$3.75
5.	1 dollar and quarters 2	$1.50
6.	2 dollars and quarters 3	$2.75
7.	1 dollar and quarter 1	$1.25

	Fraction using fourths	Decimal
8.	$\frac{3}{4}$	0.75
9.	$\frac{2}{4}$	0.50
10.	$2\frac{1}{4}$	2.25
11.	$1\frac{1}{4}$	1.25
12.	$3\frac{2}{4}$	3.50

Write the fraction that completes each sentence.

13. $0.75 is $\frac{3}{4}$ of the value of 1 dollar.

14. The value of 2 quarters is $\frac{2}{4}$ of the value of 1 dollar.

297

Page 297

LESSON OUTCOME

Relate fourths, quarters, and decimal amounts of money

Materials

play money or cutouts (quarters and dollars) from pages T 351 and T 352

Prerequisite Skills

Use dollars-and-cents notation to write amounts of money

Checking Prerequisite Skills

Copy and complete the chart.

	Value in cents	Value in dollars
1.	225¢	$2.25
2.	150¢	$1.50
3.	75¢	$0.75
4.	375¢	$3.75
5.	425¢	$4.25

RELATED ACTIVITIES

- Many grocery items are marked to show the mass or the volume of the contents, for example, 2.5 L. Have students find examples of such items and, if possible, bring the empty containers to school. For the amounts that involve halves and fourths, have students write the decimal as a fraction and vice versa.

ESSON ACTIVITY

sing the Page

Ask the students if they know why our coin, the quarter, is given the name *quarter*. (The word *quarter* is a synonym for "fourth", because it is derived from the Old French word *quartier*, meaning one-fourth part.) Have a student read the statement at the top of the page. Review that $0.25 means 25 hundredths of a dollar. Then read the statement that explains the name *quarter*. Emphasize that $\frac{1}{4}$ and 0.25 each name the same amount, and thus may be used interchangeably. If necessary, use play money or cutouts from pages T 351 and T 352.

Vorking Together: Ex. 1-3 relate fourths and the value of a number of quarters. Ex. 4-7 relate the abstract fractions and decimals. If necessary, these may also be related to amounts of money. Use play money or cutouts from pages T 351 and T 352.

Exercises: Remind the students that the symbol $ is required in Ex. 1-7 but not in Ex. 8-12.

For Ex. 14, the fraction should be expressed in fourths. If any students write $\frac{1}{2}$, ask them to express it in fourths.

Assessment

Write the value of

1. 3 dollars and 1 quarter $3.25
2. 4 dollars and 2 quarters $4.50
3. 3 quarters $0.75
4. Copy and complete.

Fraction using fourths	Decimal
$\frac{1}{4}$	0.25
$\frac{3}{4}$	0.75
$3\frac{3}{4}$	3.75
$1\frac{2}{4}$	1.50

Pages 298-299

LESSON OUTCOME

Identify and use equivalent fractions and decimals for halves, fourths, tenths, and hundredths

Materials

models for ones, tenths, hundredths (optional), overhead projector and a grid (optional), copies of page T 368

Prerequisite Skills

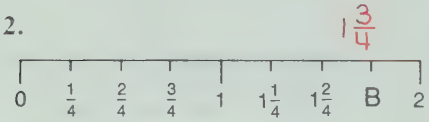
Match points on a number line with fractions or decimals

Checking Prerequisite Skills

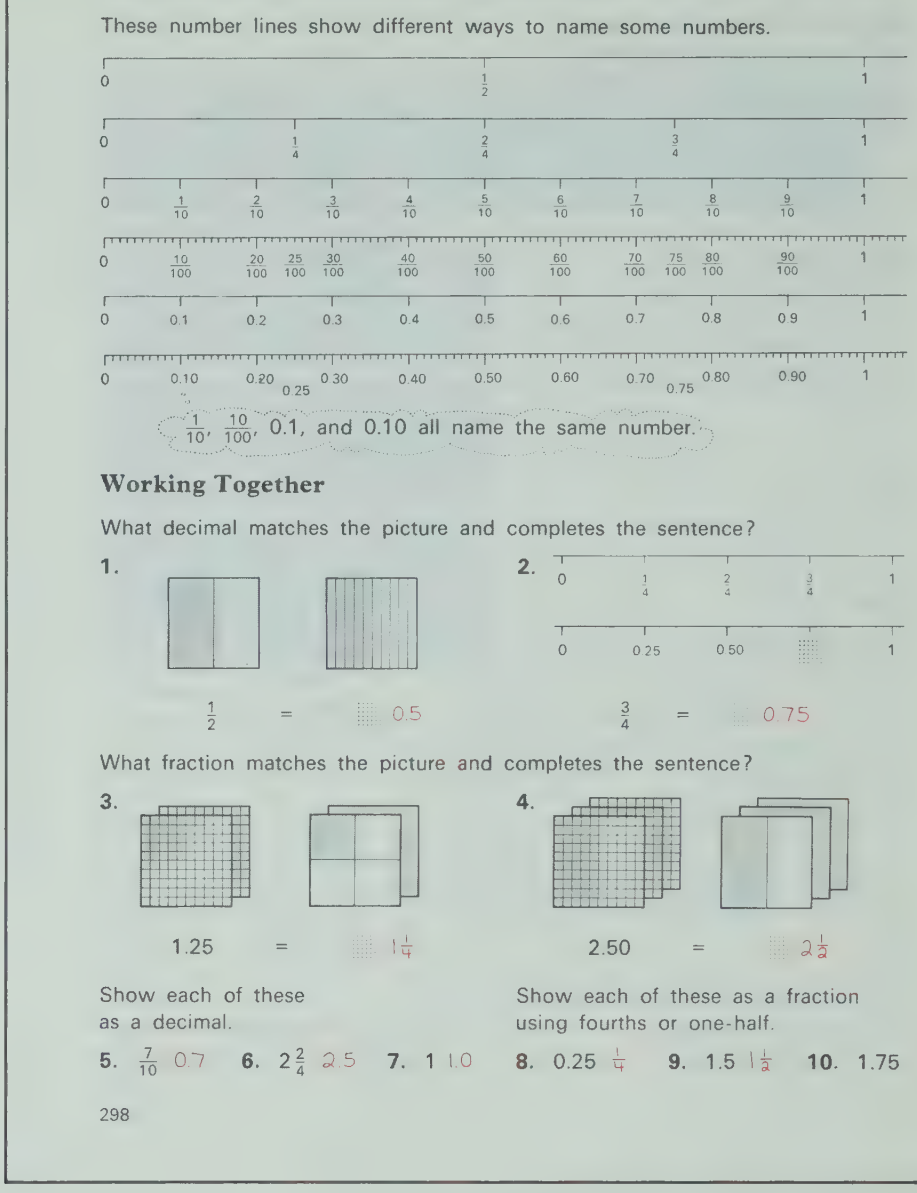
What numbers match the points marked with letters?

1.

2.



3.



Equivalent Fractions and Decimals

These number lines show different ways to name some numbers.

1/10, 10/100, 0.1, and 0.10 all name the same number.

Working Together

What decimal matches the picture and completes the sentence?

1.

1/2 = 0.5

2.

3/4 = 0.75

What fraction matches the picture and completes the sentence?

3.

1.25 = 1 1/4

4.

2.50 = 2 1/2

Show each of these as a decimal.

5. 7/10 0.7 6. 2 2/4 2.5 7. 1 1.0

Show each of these as a fraction using fourths or one-half.

8. 0.25 1/4 9. 1.5 1 1/2 10. 1.75 1 3/4

298

LESSON ACTIVITY

Using the Pages

- The number line is a useful device for showing equivalent fractions and decimals. Ask how many number lines there are and what they have in common. That is, they all show the same part of the number line (from 0 to 1).

  Have the students note that points between 0 and 1 are named differently for each number line. Establish that a point can have more than one name. For example, ask what name is shown for the point halfway between 0 and 1 on each of the six number lines, in turn. Have the students note that these points are aligned vertically in the illustration. Discuss that the scale shown for each number line influences the name for this "halfway" point. Emphasize that $\frac{1}{2}$, $\frac{2}{4}$, $\frac{5}{10}$, $\frac{50}{100}$, 0.5, and 0.50 are names for the same number.

  The students will notice that the scales of the first two number lines are not convenient for naming tenths. Have them relate the names for one-tenth on the remaining number lines. Use other similar examples by questioni the students about the number lines. For example,
  "What name does the last number line show f one-fourth?"
  "What are some names for three-fourths?"

Working Together: For Ex. 1-4, diagrams are provided to he students write fractions as decimals and vice versa. For E 5-10, have students use models or refer to the number li for assistance if necessary.

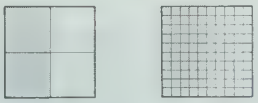
Exercises: Before the students begin, you may wish to discu the diagrams for Ex. 1-4. For Ex. 1, for example, discu that the first diagram shows fourths and the second diagra shows hundredths. The same amount is shown in blue each, so they suggest different names for the same numbe

Note that both 3.5 and 3.50 in Ex. 6 are acceptable.

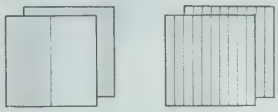
Try This: If an overhead projector and a grid are not availabl pin the shape over a sheet of graph paper and trace outline. (Copies of page T 368 may be used.)

Exercises

Write the decimal that matches the picture and completes the sentence.

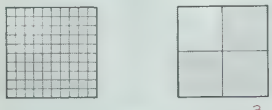
1. 

$\frac{2}{4}$ = 0.5

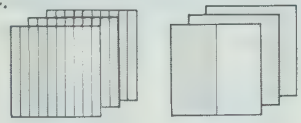
2. 

$1\frac{1}{2}$ = 1.5

Write the fraction that matches the picture and completes the sentence.

3. 

0.75 = $\frac{3}{4}$

4. 

2.5 = $2\frac{1}{2}$

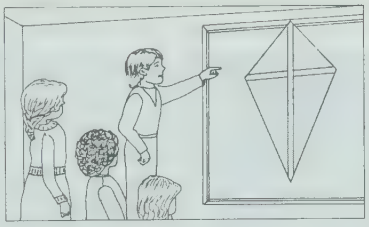
Write each of these as a decimal.

5. $\frac{1}{4}$ 0.25 **6.** $3\frac{1}{2}$ 3.5 **7.** $1\frac{3}{4}$ 1.75

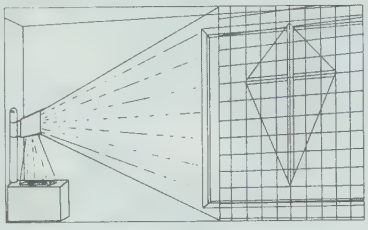
Write each of these as a fraction showing fourths or one-half.

8. 2.25 $2\frac{1}{4}$ **9.** 0.50 $\frac{1}{2}$ **10.** 3.75 $3\frac{3}{4}$

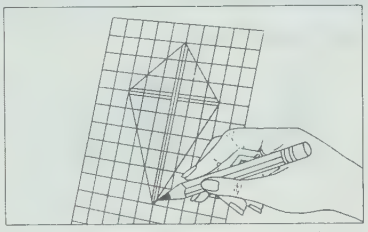
To make a pattern, the class hung a kite on the wall.



Next, they placed a grid over the kite.



Then they copied the kite on graph paper.

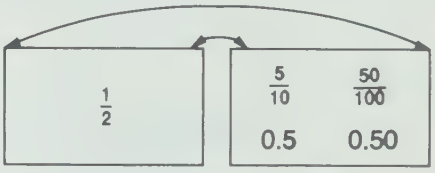


1. Make a pattern in the way suggested above.

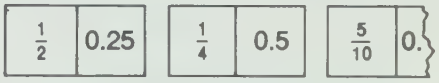
try this

RELATED ACTIVITIES

- Using copies of pages T 363, T 364, and T 365, have students help to color diagrams for halves, fourths, and wholes, similar to those on pages 298 and 299. These may be used by students to represent equivalent fractions and decimals. For example, students may work in pairs to show two names for the numbers in Ex. 5-10 on page 298 and Ex. 5-10 on page 299.
- A set of flash cards may be prepared for fractions and decimals. One side of the card shows one name for a number. The other side shows equivalent names for the number. If students work in pairs, one student may display the side of the card showing one name and ask for other names. The reverse side of the card serves to check the answers given.

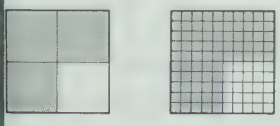


- Students may follow the rules for dominoes and play using domino cards prepared for equivalent fractions and decimals.



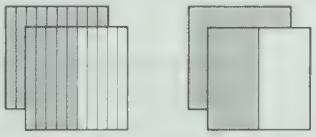
sessment

ite the decimal that tches the picture and com- tes the sentence.



$\frac{3}{4}$ = 0.75

Write the fraction that matches the picture and completes the sentence.

2. 

1.5 = $1\frac{1}{2}$

ite each as a decimal.

$1\frac{1}{4}$ 1.25 **4.** $2\frac{1}{2}$ 2.5 or 2.50

ite each of these as a ction showing fourths or -half.

1.50 **6.** 1.75

$1\frac{2}{4}$ or $1\frac{1}{2}$ $1\frac{3}{4}$

Pages 300-301

LESSON OUTCOME

Compare and order fractions less than 1 (halves, fourths, tenths, hundredths) using decimal equivalents

Materials

models for decimals and fractions (optional)

Prerequisite Skills

Compare and order decimals

Checking Prerequisite Skills

Which is greater,

1. 0.25 or 0.30? 0.30

Which is less,

2. 0.75 or 0.90? 0.75

List in order from least to greatest.

3. 0.45, 0.20, 0.75, 0.60

0.20, 0.45, 0.60, 0.75

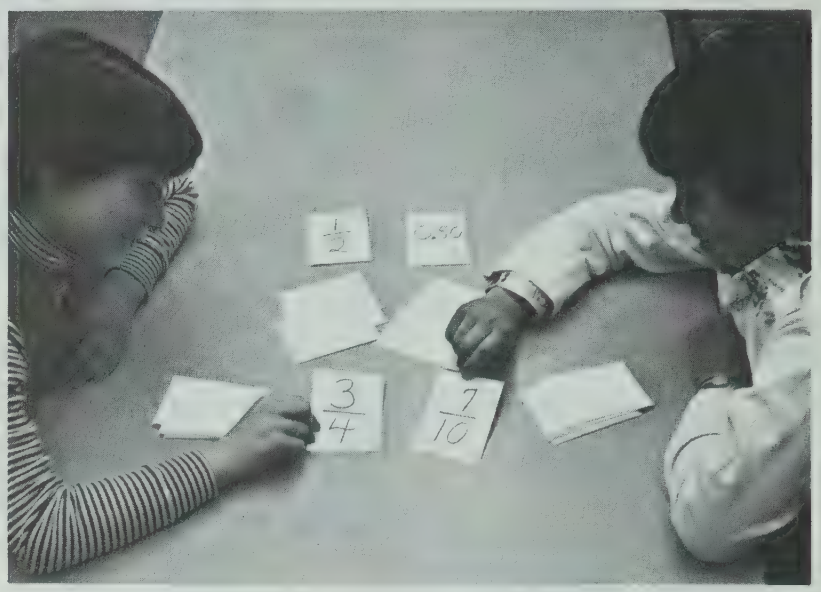
Background

In this lesson, students compare and order fractions less than 1. The concept is fairly abstract if carried out through a procedure of finding a common denominator. At this level, an easier procedure involves changing the common fractions to equivalent decimals.

Comparing and Ordering Fractions

In this game, the player showing the greater number wins the cards. The first numbers that Mara and Joey turned over were equal. Then Mara turned over $\frac{3}{4}$ and Joey turned over $\frac{7}{10}$. Who won the cards?

$\frac{1}{2} = 0.50$



Mara turned over $\frac{3}{4}$.

$\frac{3}{4}$ = 0.75

Joey turned over $\frac{7}{10}$.

$\frac{7}{10}$ = 0.70

0.75 is greater than 0.70.

$\frac{3}{4}$ is greater than $\frac{7}{10}$.

0.75 > 0.70

$\frac{3}{4} > \frac{7}{10}$

Mara won the cards.

300

LESSON ACTIVITY

Before Using the Pages

- Spend a few moments reviewing the work of the previous lesson. Write a few numerals on the board and have students write the equivalent fractions and/or decimals. Use models for ones, tenths, hundredths, halves, and fourths as needed.

  $\frac{1}{4}$ $\frac{3}{10}$ 0.5 0.70

  Tell the students that it is helpful to know different names for a number because, sometimes, one of the names is more useful than the other names.

Using the Pages

- Have a student read the statements at the top of page 300 to introduce the situation. Remind the students that the greater number is always the winning number. Ask which they think is greater, three-fourths or seven-tenths, and have a few students give their opinions with reasons. (Some may say, for example, that they think $\frac{7}{10} > \frac{3}{4}$ because $7 > 3$ and $10 > 4$. But this reasoning is incorrect; for exam $\frac{3}{4} > \frac{65}{100}$ although 65 and 100 are much greater than 3 an respectively. Similarily, $\frac{8}{100}$ is not greater than $\frac{7}{10}$.) W there are no new opinions, lead the students through solution shown beneath the photograph. Emphasize 0.75 names the same number as $\frac{3}{4}$, and 0.70 names same number as $\frac{7}{10}$. Point out that these alternate na make it easier to find which of the two numbers is grea

Working Together: These exercises emphasize compar fractions by comparing their decimal equivalents. Ass ance is provided by identifying the steps to be followe Ex. 1 and 2 only. To ensure that the students understand procedure, have them identify the steps needed to ans Ex. 3-5:

(1) decide whether one-place decimals or two-place d mals are preferable;
(2) write the decimal equivalents for the fractions;
(3) compare (order) the decimals;
(4) write the conclusion for the fractions.

Working Together

Give a one-place decimal for each fraction. Tell which of the two decimals is greater. Then tell which of the fractions is greater.

1.

Fraction	Decimal	
$\frac{1}{2}$	0.5	$0.6 > 0.5$
$\frac{6}{10}$	0.6	$\frac{6}{10} > \frac{1}{2}$

Give a two-place decimal for each fraction. Tell which of the two decimals is greater. Then tell which of the fractions is greater.

2.

Fraction	Decimal	
$\frac{1}{4}$	0.25	$0.25 > 0.20$
$\frac{2}{10}$	0.20	$\frac{1}{4} > \frac{2}{10}$

Use > or < to make a true statement.

3. $\frac{1}{2} > \frac{40}{100}$

4. $\frac{6}{10} < \frac{3}{4}$

List in order from least to greatest.

5. $\frac{1}{2}, \frac{4}{10}, \frac{1}{4}, \frac{3}{4}$ $\quad \frac{1}{4}, \frac{4}{10}, \frac{1}{2}, \frac{3}{4}$

Exercises

Use > or < to make a true statement.

1. $\frac{2}{4} > \frac{2}{10}$

2. $\frac{1}{2} < \frac{3}{4}$

List in order from least to greatest.

3. $\frac{1}{4}, \frac{3}{10}, \frac{2}{4}, \frac{1}{10}$ $\quad \frac{1}{10}, \frac{1}{4}, \frac{3}{10}, \frac{2}{4}$

Who won each pair of cards? Who won the most cards?

4. $\frac{1}{4}$ Mara; $\frac{30}{100}$ Joey

5. $\frac{40}{100}$ Mara; 0.5 Joey

6. $\frac{2}{4}$ Mara; $\frac{1}{2}$ Joey

7. $\frac{9}{10}$ Mara; $\frac{20}{100}$ Joey

RULES FOR THE GAME

1. Deal all the cards.
2. Each player turns up 1 card at a time.
3. The player whose card shows the greater number wins both cards.
4. If both cards show equal numbers, each player places 3 cards face down. Then each turns up another card. Compare. The greater number wins the 10 cards that have been played.
5. When the game ends, the player with the most cards is the winner.

8. $\frac{7}{10}$ Mara; 0.10 Joey

9. $\frac{3}{4}$ Mara; $\frac{8}{10}$ Joey

10. $\frac{6}{10}$ Mara; 0.60 Joey

11. 0.40 Mara; 0.8 Joey

Joey won the most cards.

ercises: Have the students show their work for these exercises. For example, for Ex. 1 they may think and write the solution in steps:

$\frac{2}{4} = 0.5 \quad \frac{2}{10} = 0.2$

$0.5 > 0.2$

$\frac{2}{4} > \frac{2}{10}$

Note that for Ex. 11, students may change 0.40 to 0.4 or they may change 0.8 to 0.80.

sessment

> or < to make a true statement.

1. $\frac{1}{2} < \frac{60}{100}$
2. $\frac{5}{10} > 0.40$
3. $\frac{1}{2} < \frac{3}{4}$
4. $0.2 > 0.15$

in order from least to greatest.

$\frac{6}{10}, \frac{1}{4}, \frac{3}{4}, \frac{1}{2}$ $\quad \frac{1}{4}, \frac{1}{2}, \frac{6}{10}, \frac{3}{4}$

RELATED ACTIVITIES

- Have students work in pairs to prepare a set of 42 cards as follows:

$\frac{1}{10}, \frac{2}{10}, \frac{3}{10}, \ldots, \frac{9}{10}$

0.1, 0.2, 0.3, . . ., 0.9

$\frac{10}{100}, \frac{20}{100}, \frac{30}{100}, \ldots, \frac{90}{100}$

0.10, 0.20, 0.30, . . ., 0.90

$\frac{1}{2}, \frac{1}{4}, \frac{2}{4}, \frac{3}{4}$

0.25, 0.75

Have them use the cards to play the game as discussed on page 301.

- A game similar to the one described on page 301 may be played using models for numbers less than one. A set of 24 cards includes models of 0.1 to 0.9 (page T364), models of 0.10 to 0.90, and 0.25 and 0.75 (page T365), models of $\frac{1}{2}, \frac{1}{4}, \frac{2}{4}$, and $\frac{3}{4}$ (page T363).
- Have students help to prepare charts similar to the following for display in the classroom. They may be used for reference and review.

Names for the same number
$\frac{1}{2}$, one-half
$\frac{2}{4}$, two-fourths
$\frac{5}{10}$, five-tenths, 0.5
$\frac{50}{100}$, fifty-hundredths, 0.50

Names for the same number
$\frac{1}{4}$, one-fourth
0.25, twenty-five hundredths

Pages 302-303

LESSON OUTCOME

Identify and use equivalent fraction names for 1

Materials

tracing paper for each student

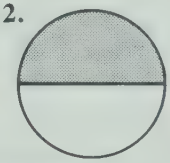
Prerequisite Skills

Write fractions for parts of a whole (halves, fourths, tenths)

Checking Prerequisite Skills

Write the fraction to show how much is shaded.

1. $\frac{3}{4}$

2.  $\frac{1}{2}$

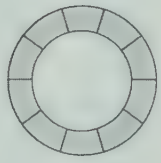
3. $\frac{7}{10}$

Fraction Names for 1

If is $\frac{1}{2}$, then is $\frac{2}{2}$.

But is 1. $\frac{2}{2}$ and 1 name the same amount.

$$\frac{2}{2} = 1$$

If is $\frac{1}{10}$, then  is $\frac{10}{10}$.

But is 1. $\frac{10}{10}$ and 1 name the same amount.

$$\frac{10}{10} = 1$$

If is $\frac{1}{4}$, then is $\frac{4}{4}$.

But is 1. $\frac{4}{4}$ and 1 name the same amount

$$\frac{4}{4} = 1$$

302

LESSON ACTIVITY

Using the Pages

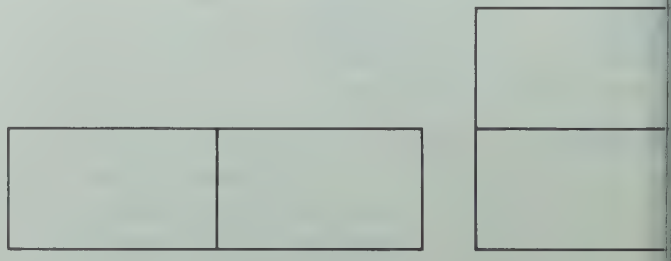
- Review that the previous lessons have involved writing different names for the same number. Tell the students that in today's lesson they are going to look at ways of using fractions to name the number one.

  Have students identify the letters shown in blue on page 302. Then discuss each of the letters, in turn. For example, two halves together form the (whole) letter S, ten tenths are needed to form the (whole) letter O, and four fourths are needed to form the last letter S. Some students may be interested in using tracing paper to match each of the tenths on the letter O, for example, with the part indicated as one-tenth.

  Summarize the lesson by asking questions such as, "How many halves are the same as one whole?" Point out the numerals, $\frac{2}{2}$, $\frac{10}{10}$, and $\frac{4}{4}$. Emphasize that each is a different fraction name for the number one.

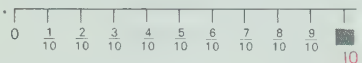
Working Together: Ex. 1-3 show the part of the number l from 0 to 1 scaled in tenths, fourths, and halves. Disc that in Ex. 1 there are 10 equal parts from 0 to 1, and fraction name for 1 on this number line is $\frac{10}{10}$. Discuss Ex and 3 in a similar manner.

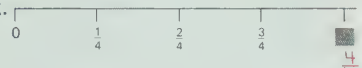
Provide the students with tracing paper for Ex. 4 and Encourage them to explore more than one possibility each exercise. For example, for Ex. 4, a student may sh each of the following as a shape for 1. Students can tr the shape once, slide the tracing paper to a new positi and trace the shape again to obtain a shape for 1.



Working Together

Give a fraction name for 1 for each number line.

1. 

2. 

3.

Use tracing paper and draw a shape for 1.

4-5. Shapes will vary.

4. if is $\frac{1}{2}$.

5. if is $\frac{1}{4}$.

Exercises

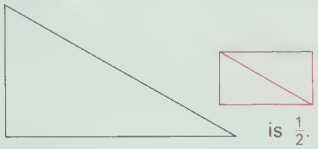
Write the fraction name for 1 that fits each pattern.

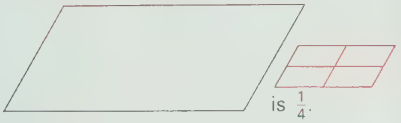
1. $\frac{1}{4}, \frac{2}{4}, \frac{3}{4}, \ldots$ $\frac{4}{4}$

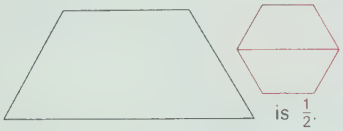
2. $\frac{2}{10}, \frac{4}{10}, \frac{6}{10}, \frac{8}{10}, \ldots$ $\frac{10}{10}$

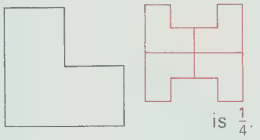
Use tracing paper and draw a shape for 1.

Ex. 3-8. Shapes will vary. See possible shapes given below.

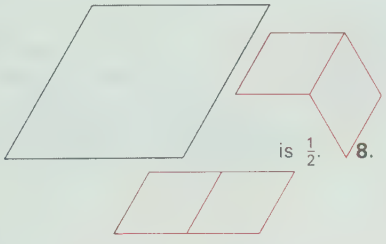
3. if  is $\frac{1}{2}$.

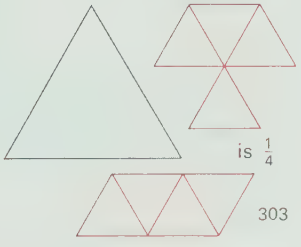
4. if  is $\frac{1}{4}$.

5. if  is $\frac{1}{2}$.

6. if  is $\frac{1}{4}$.

Draw two different shapes for 1.

7. if  is $\frac{1}{2}$.

8. if  is $\frac{1}{4}$

RELATED ACTIVITIES

- Some students may enjoy writing exercises similar to Ex. 3-8 on page 303 for other students to complete.
- Have students write the fraction name and the whole number name to show how much is shaded for diagrams similar to the following.

$\frac{4}{4}$ or 1

$\frac{2}{2}$ or 1

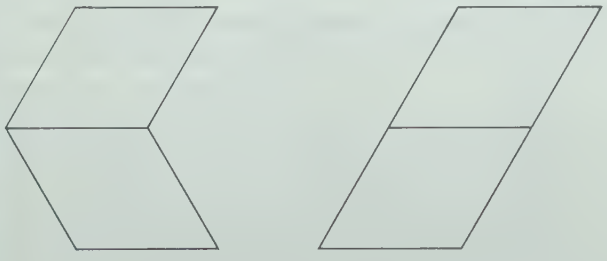
$\frac{10}{10}$ or 1

$1\frac{2}{2}$ or 2

$2\frac{4}{4}$ or 3

$1\frac{10}{10}$ or 2

ercises: Provide the students with tracing paper for Ex. 3-8. Note how exercises such as these can be thought of in terms of slides, flips, or turns. Thinking of these motions can help students to find different shapes for the same exercise, for example, in Ex. 7.



Flip Slide

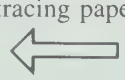
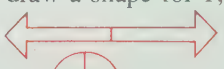
ese exercises help to prepare students for the concept of ition with fractions, such as

$$\frac{1}{2} + \frac{1}{2} = \frac{2}{2} = 1$$

Assessment

Answers may vary.

Use tracing paper and draw a shape for 1.

1. if  is $\frac{1}{2}$. 

2. if is $\frac{1}{4}$.

Complete each fraction to show a name for 1.

3. $\frac{?}{4}$ $\frac{4}{4}$ 4. $\frac{?}{2}$ $\frac{2}{2}$ 5. $\frac{?}{10}$ $\frac{10}{10}$

Pages 304-305

LESSON OUTCOME

Add two proper or mixed-form fractions with equal denominators for halves, fourths, and tenths (fraction parts having a sum less than or equal to one)

Materials

models for halves, fourths, tenths, and wholes as described in the Overview on page T 317

Prerequisite Skills

Write fraction and decimal equivalents for halves, fourths, and tenths; add decimals

Checking Prerequisite Skills

Write each of these as a decimal.

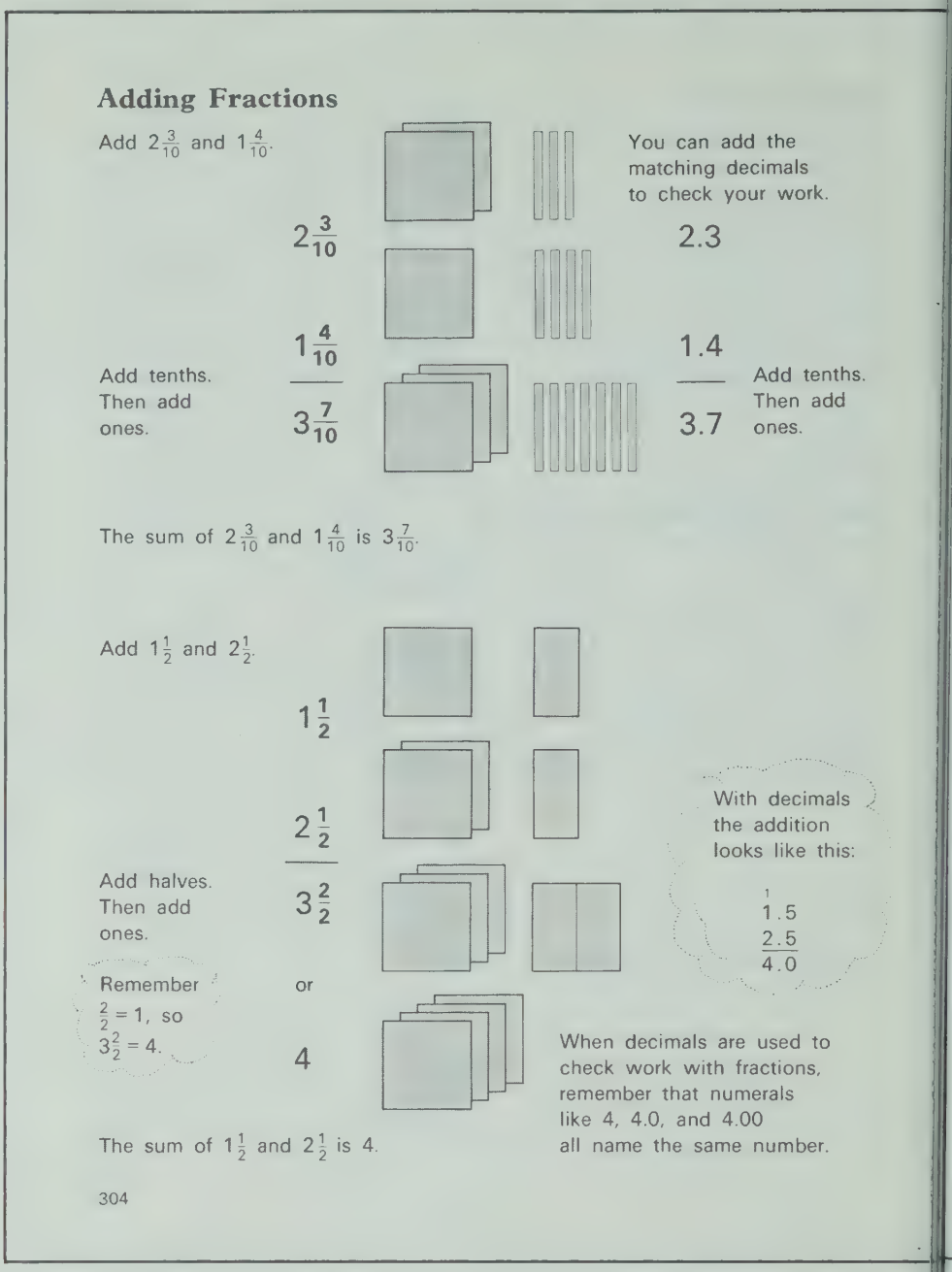
1. $5\frac{6}{10}$ 5.6 **2.** $1\frac{1}{2}$ 1.5 **3.** $2\frac{1}{4}$ 2.25 **4.** $\frac{3}{4}$ 0.75

Write each of these as a fraction using fourths or one-half.

5. 3.25 $3\frac{1}{4}$ **6.** 6.50 $6\frac{1}{2}$ **7.** 1.75 $1\frac{3}{4}$

Add.

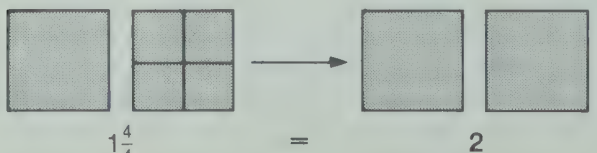
8. 2.3 + 1.4 = 3.7 **9.** 1.25 + 4.25 = 5.50 **10.** 3.5 + 3.5 = 7.0



LESSON ACTIVITY

Before Using the Pages

- Review that $\frac{2}{2}$, $\frac{4}{4}$, and $\frac{10}{10}$ are fraction names for the number 1. Display models of wholes marked into halves, fourths, and tenths as needed to help students recall this equivalence (see page T 317).
- Write numerals for fractions on the board. Have students read the numerals and display models to represent the fractions. Begin with examples such as $2\frac{1}{2}$, $3\frac{6}{10}$, and $1\frac{3}{4}$. Then introduce examples such as $3\frac{2}{2}$, $1\frac{4}{4}$, and $2\frac{10}{10}$. For examples of this second type, discuss a simpler way to write the number represented by each. Make appropriate changes in the models, as shown below.



Explain that such numerals as $1\frac{4}{4}$ and $3\frac{2}{2}$ are freque encountered in the sums of fractions, and that they rewritten as whole numbers.

Using the Pages

- The two worked examples present addition of fractions another way of writing a previously-learned skill, tha addition of decimals. The additions are shown with fractions and then with the equivalent decimals, the la serving to check the work with fractions. Both forms of addition are supported by the same illustrations of mod

  Discuss the examples with the students. Relate e addend and sum (fractional and decimal) to the appropr models. In the first example, emphasize that for each f of the addition, the tenths are added first, then the ones the second example, adding the halves first correspond adding the tenths first in the decimal form of the addit Review that $1\frac{1}{2}$ equals 1.5 and $2\frac{1}{2}$ equals 2.5. D attention to the reminder "$\frac{2}{2} = 1$, so $3\frac{2}{2} = 4$". Ask students whether the sums 4 and 4.0 name the s

Working Together

Complete each pair of addition sentences.

1. $1 + 2 =$ ▒ 3 $\quad \frac{1}{4} + \frac{2}{4} =$ ▒ $\frac{3}{4}$
2. $6 + 3 =$ ▒ 9 $\quad \frac{6}{10} + \frac{3}{10} =$ ▒ $\frac{9}{10}$

Add the whole numbers to complete each addition.

3. $1\frac{2}{4} + 2\frac{1}{4} =$ ▒ $\frac{3}{4}$ 3
4. $3\frac{5}{10}$ + $2\frac{1}{10}$ = 5 $\frac{6}{10}$

Add the fractions. Then add the whole numbers.

5. $1\frac{2}{10} + 4\frac{5}{10}$ $5\frac{7}{10}$
6. $1\frac{1}{4}$ + $3\frac{1}{4}$ $4\frac{2}{4}$

Rename the sum.

7. $3\frac{3}{10} + 1\frac{7}{10} = 4\frac{10}{10}$ 5
8. $\frac{1}{4}$ + $\frac{3}{4}$ = $\frac{4}{4}$ 1

Add. The sums for each pair should match.

9. $\frac{6}{10} + \frac{2}{10}$ $\frac{8}{10}$ $\quad$ 0.6 + 0.2 0.8
10. $1\frac{1}{4}$ + $2\frac{3}{4}$ = 4 $\quad$ 1.25 + 2.75 = 4.00

Add. Check by using decimals.

11. $1\frac{4}{10} + \frac{6}{10}$ 2 $\quad$ 1.4 + 0.6 = 2.0
12. $4\frac{1}{4}$ + $2\frac{2}{4}$ = $6\frac{3}{4}$ $\quad$ 4.25 + 2.50 = 6.75
13. $1\frac{1}{2}$ + $3\frac{1}{2}$ = 5 $\quad$ 1.5 + 3.5 = 5.0

Exercises

Add. Check by using decimals.

1. $2\frac{1}{4} + 3\frac{1}{4}$ $5\frac{2}{4}$
2. $1\frac{3}{10} + \frac{2}{10}$ $1\frac{5}{10}$
3. $2\frac{1}{2} + 3\frac{1}{2}$ 6
4. $\frac{8}{10} + \frac{2}{10}$ 1
5. $2\frac{3}{4} + 1\frac{1}{4}$ 4
6. $3\frac{1}{2} + 2$ $5\frac{1}{2}$
7. $2\frac{5}{10} + 4\frac{5}{10}$ 7
8. $3 + 1\frac{3}{4}$ $4\frac{3}{4}$
9. $1\frac{3}{4}$ + 3 = $4\frac{3}{4}$
10. $1\frac{5}{10}$ + $1\frac{3}{10}$ = $2\frac{8}{10}$
11. $2\frac{7}{10}$ + $3\frac{3}{10}$ = 6
12. $1\frac{2}{4}$ + $\frac{2}{4}$ = 2
13. $\frac{7}{10}$ + $3\frac{1}{10}$ = $3\frac{8}{10}$
14. $2\frac{4}{10}$ + $5\frac{3}{10}$ = $7\frac{7}{10}$
15. $4\frac{1}{2}$ + $4\frac{1}{2}$ = 9
16. $3\frac{1}{4}$ + $6\frac{3}{4}$ = 10
17. $1\frac{2}{10}$ + $1\frac{6}{10}$ = $2\frac{8}{10}$
18. $8\frac{2}{10}$ + $2\frac{8}{10}$ = 11

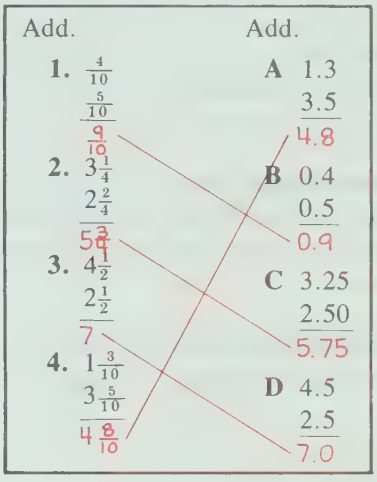
Solve.

19. Martha had $3\frac{1}{2}$ biscuits. Danny had $1\frac{1}{2}$ biscuits. How many did they have in all? 5
20. Liz read $2\frac{3}{4}$ pages yesterday and $3\frac{1}{4}$ pages today. How many pages did she read in all? 6

305

RELATED ACTIVITIES

• Prepare a work sheet similar to the following. Have students complete the exercises and then match each fraction addition with the corresponding decimal addition. The sums should be equal, for example, Ex. 1 matches Ex. B.



• Students may use copies of the grid on page T 361 to complete addition tables similar to the following.

+	$\frac{1}{4}$	$\frac{2}{4}$	$\frac{3}{4}$
$\frac{1}{4}$	$\frac{2}{4}$		
$\frac{2}{4}$			
$\frac{3}{4}$			

+	$3\frac{1}{2}$	$5\frac{1}{2}$
$2\frac{1}{2}$	6	
4		

number. Draw their attention to the statement regarding this at the bottom of page 304.

Summarize the steps to emphasize that addition of fractions is similar to addition of decimals:
(1) add the fractional (or decimal) parts first;
(2) add the whole numbers.

Point out that with decimals the regrouping is carried out during the addition, whereas with fractions the sum is regrouped.

Working Together: Ex. 1 and 2 help to show that addition of fractions involves addition of the numerators (denominators are names indicating sizes of parts and are not added). Ex. 3 and 4 emphasize that the whole numbers are added after the fractions have been added. (Have the students add the fractions to understand their sums.) Ex. 5 and 6 apply the skills of Ex. 1-4. Ex. 7 and 8 require the skill of renaming a sum. Note that at this level, the students are not involved in renaming the sum $4\frac{2}{4}$ as $4\frac{1}{2}$ (see Ex. 6). The renaming involves only fraction names for the number one. Ex. 9 and 10 emphasize checking addition of fractions by adding the corresponding decimals. All of the previous skills are applied in Ex. 11-13 for which the students are required to work independently. Note the skills that seem to be giving difficulty and provide other appropriate exercises as required. If necessary, use models to demonstrate the additions.

Exercises: Have the students complete the exercises in the horizontal or vertical forms as given. The additions for Ex. 19 and 20 may be written using either form.

Assessment

Add. Check by using decimals.

1. $\frac{3}{10} + \frac{5}{10}$ $\frac{8}{10}$
2. $1\frac{3}{4} + 3$ $4\frac{3}{4}$
3. $2\frac{1}{2}$ + $6\frac{1}{2}$ = 9
4. $3\frac{1}{4}$ + $2\frac{3}{4}$ = 6
5. $1\frac{4}{10}$ + $3\frac{5}{10}$ = $4\frac{9}{10}$

Pages 306-307

LESSON OUTCOME

Subtract proper or mixed-form fractions with equal denominators for halves, fourths, and tenths (whole number minuends or minuends with fractions greater than or equal to fractions in the subtrahend)

Materials

models for wholes, halves, fourths, and tenths (optional)

Prerequisite Skills

Write fraction and decimal equivalents for halves, fourths, and tenths; subtract decimals

Checking Prerequisite Skills

Write each of these as a decimal.

1. $2\frac{1}{2}$ 2.5 **2.** $4\frac{9}{10}$ 4.9 **3.** $1\frac{3}{4}$ 1.75

Write each of these as a fraction using fourths or one-half.

4. 3.5 $3\frac{1}{2}$ **5.** 2.75 $2\frac{3}{4}$ **6.** 1.25 $1\frac{1}{4}$

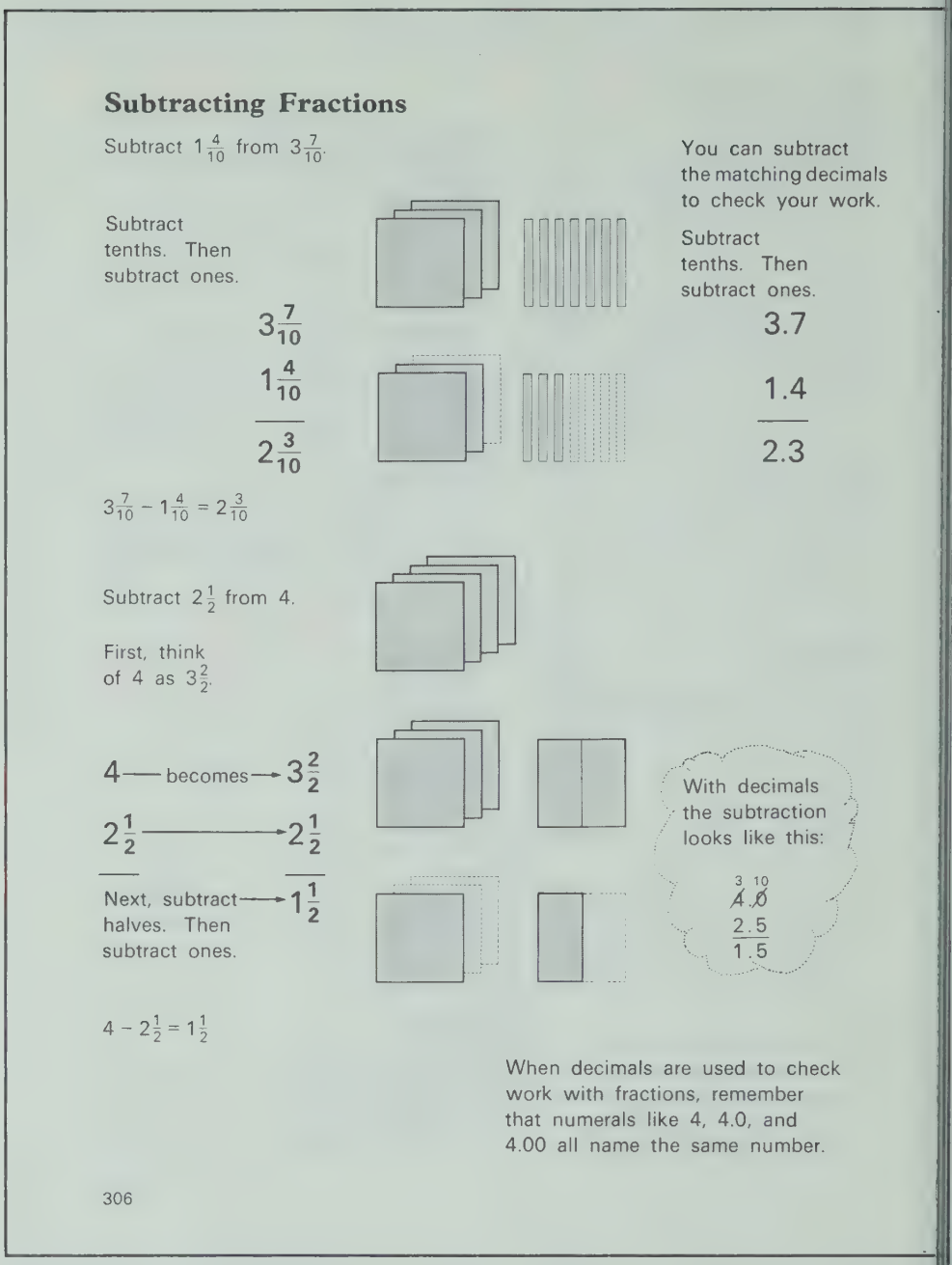
Subtract.

7. 3.7 − 1.4 = 2.3

8. 4.0 − 2.5 = 1.5

9. 8.50 − 1.25 = 7.25

10. 6.00 − 3.25 = 2.75



Subtracting Fractions

Subtract $1\frac{4}{10}$ from $3\frac{7}{10}$.

Subtract tenths. Then subtract ones.

$3\frac{7}{10}$
$1\frac{4}{10}$
$2\frac{3}{10}$

$3\frac{7}{10} - 1\frac{4}{10} = 2\frac{3}{10}$

You can subtract the matching decimals to check your work.

Subtract tenths. Then subtract ones.

3.7
1.4
2.3

Subtract $2\frac{1}{2}$ from 4.

First, think of 4 as $3\frac{2}{2}$.

4 becomes $3\frac{2}{2}$
$2\frac{1}{2}$ → $2\frac{1}{2}$

Next, subtract halves. Then subtract ones. → $1\frac{1}{2}$

$4 - 2\frac{1}{2} = 1\frac{1}{2}$

With decimals the subtraction looks like this:

3 10
4.0
2.5
1.5

When decimals are used to check work with fractions, remember that numerals like 4, 4.0, and 4.00 all name the same number.

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LESSON ACTIVITY

Before Using the Pages

- Have students complete a few exercises, similar to the following, for which they are required to rename the numbers as whole numbers.

  $4\frac{2}{2} =$ ⬚ $3\frac{10}{10} =$ ⬚ $7\frac{4}{4} =$ ⬚

- Write exercises, similar to the following, on the board and complete them with the students. These will prepare them for renaming minuends in subtraction. If necessary, use models to develop each exercise.

  $3 = 2\frac{?}{4}$ $6 = 5\frac{?}{2}$ $4 = 3\frac{?}{10}$

Using the Pages

- The worked examples show subtraction with fractions and with the corresponding decimals. The first subtraction involves no regrouping but the second subtraction does. Relate each subtraction to the appropriate models. Point out in the second example that with the fractions, 1 of the 4 ones is thought of as 2 halves. With decimals, 1 of the 4 ones is regrouped as 10 tenths. Emphasize that $1\frac{1}{2}$ and 1 (the differences) name the same number. Summarize t steps:
  (1) regroup (or rename) the minuend if necessary;
  (2) subtract the fractional (or decimal) part first;
  (3) subtract the whole numbers.

Working Together: The following sub-skills are dealt with Ex. 1-6.

1. Fractions are subtracted first and then whole numbe are subtracted (Ex. 1 and 2).
2. One whole must sometimes be renamed as a fraction the minuend (Ex. 3 and 4).
3. Subtraction with corresponding decimals can be used check the difference in subtraction with fractions (Ex and 6). These skills are applied in Ex. 7 and 8 whi require the students to work independently. Note t skills with which students seem to be having difficu and provide appropriate additional exercises. If nece sary, represent the minuends with models and demo strate the subtractions.

Working Together

Subtract the fraction. Then subtract the whole number.

1. $3\frac{2}{4} - 1\frac{1}{4}$ $2\frac{1}{4}$ 2. $5\frac{9}{10}$ $-\ 2\frac{2}{10}$ $3\frac{7}{10}$

Regroup 4 as 3 and a fraction. Then subtract.

3. $4 - 1\frac{1}{2}$ $2\frac{1}{2}$ 4. 4 $-\ 2\frac{7}{10}$ $1\frac{3}{10}$

Subtract. The differences for each pair should match.

5. $2\frac{6}{10} - \frac{5}{10}$ $2\frac{1}{10}$ 6. 6 $-\ 3\frac{1}{4}$ $2\frac{3}{4}$ 6.00 $-\ 3.25$ 2.75

2.6 − 0.5 2.1

Subtract. Check by using decimals.

7. $5\frac{3}{4} - 2\frac{1}{4}$ $3\frac{2}{4}$ 8. 3 $-\ 1\frac{3}{10}$ $1\frac{7}{10}$ 3.0 $-\ 1.3$ 1.7

5.75
2.25
3.50

Exercises

Subtract. Check by using decimals.

1. $3\frac{2}{4} - 1\frac{1}{4}$ $2\frac{1}{4}$
2. $5 - 2\frac{1}{2}$ $2\frac{1}{2}$
3. $4\frac{3}{4} - 1\frac{3}{4}$ 3
4. $1 - \frac{1}{4}$ $\frac{3}{4}$
5. $6\frac{8}{10} - 4\frac{7}{10}$ $2\frac{1}{10}$
6. $3 - 1\frac{3}{4}$ $1\frac{1}{4}$
7. $2 - \frac{1}{2}$ $1\frac{1}{2}$
8. $8 - 2\frac{1}{10}$ $5\frac{9}{10}$
9. $7\frac{4}{10}$ $-\ 1\frac{3}{10}$ $6\frac{1}{10}$
10. $6\frac{1}{2}$ $-\ 2$ $4\frac{1}{2}$
11. 2 $-\ \frac{9}{10}$ $1\frac{1}{10}$
12. 5 $-\ 4\frac{2}{4}$ $\frac{2}{4}$
13. $1\frac{8}{10}$ $-\ \frac{3}{10}$ $1\frac{5}{10}$
14. $6\frac{3}{4}$ $-\ 5\frac{1}{4}$ $1\frac{2}{4}$
15. 7 $-\ 6\frac{1}{2}$ $\frac{1}{2}$
16. $9\frac{9}{10}$ $-\ 4\frac{4}{10}$ $5\frac{5}{10}$
17. 5 $-\ 1\frac{8}{10}$ $3\frac{2}{10}$
18. $3\frac{1}{2}$ $-\ 3\frac{1}{2}$ 0

Is there a fair way to share the 1 that remains when

1. 2 boys share 7 marbles? no
2. 2 girls share 7 apples? yes ($3\frac{1}{2}$ apples each)
3. 7 chairs are to be divided equally between 2 tables? no
4. 2 children share drying the dishes for a week? yes (3 days each and share on the seventh day)
5. 2 girls share 7 dimes? yes (if one dime is changed to two nickels)
6. 2 boys share 7 nickels? no
7. 7 rabbits are to be divided equally between 2 pens? no
8. 2 brothers share 7 hats? no

PROBLEM SOLVING

ercises: You may wish to have the students study the exercises first and suggest which exercises will require renaming of the minuend.

oblem Solving: Each of these exercises involves the mixed-form fraction $3\frac{1}{2}$. However, students must decide whether this answer makes sense for the situation described. For example, in Ex. 2, the apple that remains may be shared fairly by cutting it in half for each girl to have $3\frac{1}{2}$ apples. However, it does not make sense to use this procedure for Ex. 8. Sometimes, a change can help, as in Ex. 5, to share the 1 that remains. A discussion of how to interpret "a fair way" may also arise out of these exercises.

sessment

$3\frac{6}{10} - 1\frac{3}{10}$ $2\frac{3}{10}$

3. $3\frac{4}{10}$ $-\ 1\frac{4}{10}$ 2

4. 7 $-\ 1\frac{1}{2}$ $5\frac{1}{2}$

5. 6 $-\ 2\frac{3}{4}$ $3\frac{1}{4}$

$4 - 2\frac{1}{2}$ $1\frac{1}{2}$

RELATED ACTIVITIES

- Prepare a work sheet similar to the following. Have students complete the exercises and then match each fraction subtraction with the corresponding decimal subtraction. The differences should be equal, for example, Ex. 1 matches Ex. C.

Subtract.	Subtract.
1. $3\frac{3}{4}$ $-\ 1\frac{2}{4}$ $2\frac{1}{4}$	A 7.0 $-\ 2.5$ 4.5
2. 7 $-\ 2\frac{1}{2}$ $4\frac{1}{2}$	B 4.3 $-\ 2.1$ 2.2
3. $4\frac{3}{10}$ $-\ 2\frac{1}{10}$ $2\frac{2}{10}$	C 3.75 $-\ 1.50$ 2.25
4. 5 $-\ 1\frac{1}{4}$ $3\frac{3}{4}$	D 5.00 $-\ 1.25$ 3.75

- Students may use copies of the grid on page T 361 to complete subtraction tables similar to the following.

−	$1\frac{1}{4}$	$2\frac{2}{4}$	$1\frac{3}{4}$
$4\frac{3}{4}$	38		
$5\frac{2}{4}$			
8			

Page 308

OBJECTIVE

Place the decimal point in a numeral so that a statement makes sense

RELATED ACTIVITIES

- Provide other exercises similar to those on page 308. Students may help to write some of these. If possible, find examples of such statements in books, magazines, catalogs, newspaper advertisements, and from the students' own work.

Does the Statement Make Sense?

A decimal point is missing in the recipe.
The recipe should say, "Add 1.5 kg of potatoes."

Where would you place the decimal point so that each statement makes sense?

1. Earl was sent to the store with $225 for a jug of milk. $2.25
2. The scale showed that Edward gained 125 kg in one week. 1.25 kg
3. Helen drank 15 L of milk today. 1.5 L
4. Kristin's mother is 17.5 m tall. 1.75 m
5. The belt Lee wears is 8.75 cm long. 87.5 cm
6. First base was placed 2.5 m from home plate. 25 m
7. Tina has the flu and a temperature of 385 °C. 38.5 °C
8. Hugo can write his name in 0.25 s. 2.5 s
9. Kate ate 35 pancakes for lunch. 3.5 pancakes
10. Anna bought an apple for $20. $0.2
11. Cliff bought two new record albums for $1.25. $12.50

PROBLEM SOLVING Are other changes needed?

308

LESSON ACTIVITY

Using the Page

- Discuss the illustration. The chef seems to be calling for a large amount of potatoes for the recipe he is using. Have the students turn their books to enable them to read the recipe more easily and see that it calls for 15 kg of potatoes. Then suggest that there is likely an error. Have a student read the statement beneath the illustration. Emphasize that if a decimal is left out or is placed incorrectly, the meaning of the numeral is greatly changed. Write the following numerals on the board and discuss this aspect.

  150 15.0 1.50 0.15

  Have the students rewrite each of the statements in Ex. 1-11, showing the appropriate change in the numeral. Note the additional changes required for the numerals in Ex. 10 and 11. When the students have finished, discuss the exercises. Have a student read the original statement for an exercise, explain why it does not make sense, and read the corrected statement.

Checking Up

Write each of these as a decimal showing tenths.

1. $\frac{1}{2}$ 0.5 2. $2\frac{9}{10}$ 2.9 3. $3\frac{1}{2}$ 3.5

Write each of these as a decimal showing hundredths.

4. $1\frac{1}{4}$ 1.25 5. $2\frac{1}{2}$ 2.50 6. $\frac{3}{4}$ 0.75

Write a fraction to complete each sentence. Use fourths or one-half where possible.

7. 1.50 = $1\frac{1}{2}$ 8. 0.7 = $\frac{7}{10}$ 9. 2.75 = $2\frac{3}{4}$ 10. 0.25 = $\frac{1}{4}$

Use >, < or = to make true statements.

11. $\frac{1}{2}$ ◯ 0.6 < 12. 1.75 ◯ $1\frac{3}{4}$ = 13. $\frac{1}{4}$ ◯ $\frac{1}{2}$ <

14. $\frac{3}{4}$ ◯ $\frac{7}{10}$ > 15. 0.2 ◯ $\frac{1}{4}$ < 16. $\frac{4}{4}$ ◯ 1 =

17. $2\frac{1}{4}$ ◯ 2.25 = 18. $1\frac{2}{2}$ ◯ 2 = 19. $\frac{3}{4}$ ◯ $\frac{1}{2}$ >

List in order from least to greatest.

20. $\frac{1}{2}, \frac{1}{4}, \frac{3}{4}, \frac{3}{10}$ $\frac{1}{4}, \frac{3}{10}, \frac{1}{2}, \frac{3}{4}$ 21. $\frac{2}{4}, \frac{4}{10}, \frac{3}{4}, \frac{6}{10}$ $\frac{4}{10}, \frac{2}{4}, \frac{6}{10}, \frac{3}{4}$

Add.

22. $\frac{3}{10} + \frac{5}{10}$ $\frac{8}{10}$ 23. $3\frac{1}{2} + \frac{1}{2}$ 4 24. $1\frac{1}{4} + 2\frac{1}{4}$ $3\frac{2}{4}$

25. $3\frac{1}{4}$ + $\frac{3}{4}$ = 4

26. $1\frac{1}{2}$ + 2 = $3\frac{1}{2}$

27. $1\frac{2}{10}$ + $1\frac{8}{10}$ = 3

28. $4\frac{1}{4}$ + $3\frac{2}{4}$ = $7\frac{3}{4}$

Subtract.

29. $\frac{2}{4} - \frac{1}{4}$ $\frac{1}{4}$ 30. $3\frac{7}{10} - 1\frac{7}{10}$ 2 31. $2 - \frac{1}{2}$ $1\frac{1}{2}$

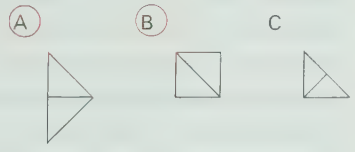
32. 5 − $3\frac{1}{2}$ = $1\frac{1}{2}$

33. $2\frac{3}{4}$ − $\frac{1}{4}$ = $2\frac{2}{4}$

34. $6\frac{9}{10}$ − 2 = $4\frac{9}{10}$

35. 4 − $1\frac{3}{4}$ = $2\frac{1}{4}$

36. If is $\frac{1}{2}$, which of these show 1?



309

Page 309

OBJECTIVE

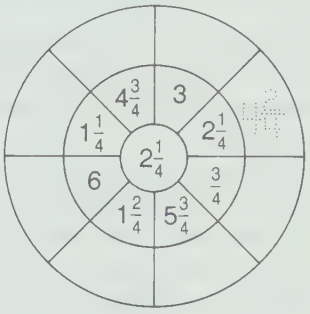
Demonstrate an understanding of the concepts and skills presented in this unit

Materials

tracing paper for each student

RELATED ACTIVITIES

- Practice in addition may be provided in the form of number wheels prepared from copies of page T 360.



- Have students write the numbers to complete exercises similar to the following.

$\frac{4}{10} + \frac{?}{10} 3 = \frac{7}{10}$ $1\frac{3}{4} - \frac{1}{?4} = 1\frac{2}{4}$

$6\frac{?}{10} 9 - 3\frac{9}{10} = 3$ $3\frac{2}{4} + ?\frac{2}{4} = 4$

- Students may enjoy exercises similar to the following.

1. is 1, then is $2\frac{1}{4}$.

2. is 1, then is $3\frac{1}{2}$.

Skills	Exercises	Related Pages
Write equivalent decimals for fractions	1-6	T 320-T 323
Write equivalent fractions for decimals	7-10	T 320-T 323
Compare and order fractions and decimals	11-21	T 324-T 325
Identify and use equivalent fraction names for 1	16,18,36	T 326-T 327
Add fractions, denominators for halves, fourths, and tenths	22-28	T 328-T 329
Subtract fractions, denominators for halves, fourths, and tenths	29-35	T 330-T 331

Comments

You may need to review with the students the instructions that precede Ex. 7. Also, point out that the instructions for Ex. 11-19 include the symbol = as well as the symbols > and <. Some students may require tracing paper to help them answer Ex. 36, which has two possible answers.

Students having difficulties with Ex. 1-10 may need more work with models to help them understand equivalent fractions and decimals. An improvement in this area will likely result in an improvement in comparison, addition, and subtraction of fractions. Students who tend to add or subtract denominators can be helped by working with models to find sums and differences.

Theme for Unit 2: Farming

The study of farming by your class will depend on whether the majority of the students are from an urban or a rural area. If most of the students live in a town or city, this theme will provide an opportunity for them to learn about the lifestyles of those who live on farms.

Provincial Ministries of Agriculture and Food hire agricultural representatives to work in county offices as liaison among farmers, local residents, schools, processing firms, and government departments. Invite one of these representatives to talk to your class about aspects of farming in which the students express an interest.

Farming Areas in Canada

Only certain areas of Canada have soil suitable for farming. Some of these are listed below.

— the Peace River region in northeastern British Columbia
— the Lower Fraser Valley and the Okanagan Valley
— the grasslands across southern Alberta, Saskatchewan, and Manitoba
— the Great Lakes Lowland in Ontario
— the St. Lawrence-Ottawa Lowland
— the area around the Bay of Fundy in Nova Scotia
— the St. John River Valley in New Brunswick
— Prince Edward Island
— the Avalon Peninsula in Newfoundland

Have students mark each of these areas on an outline map of Canada. Encourage them to find and mark other farming areas on the map.

Discuss the regions of Canada that are not suitable for farming and the reasons why they are not suitable. For example, a region may be too dry, the soil too rocky, or the weather too cold.

Kinds of Farming in Canada

The kinds of crops grown and the kinds of livestock raised vary for different farms and for different locations, as indicated in the following list.

British Columbia	— dairy cattle
	— poultry
	— apples, other fruits, vegetables
Prairie Provinces	— cereal crops, hay, clover
	— sugar beets
	— beef cattle
	— dairy cattle
	— hogs
Ontario and Quebec	— dairy cattle
	— beef cattle
	— oats, hay, corn
	— hogs
	— poultry
	— beans, peas, and other vegetables
	— grapes, peaches, and other fruits
Atlantic Provinces	— potatoes
	— apples, pears, plums, and other fruits

Have the students mark on a map of Canada the kinds of farming carried on in each area. You may wish to have them use reference books to find the specific kinds of cereal crops grown in the Prairie Provinces or the names of other fruits and vegetables grown in Ontario and Quebec.

You may wish to have the students cut pictures of far produce from magazines and newspapers and glue them on map of their home province or territory. You may prefer to hav the students prepare a large map of Canada and use it as backdrop for samples of food grown or processed in Canad Show where each kind of food is produced by connecting it the appropriate location on the map with a piece of string.

Mixed Farming

A study of the history of farming will show that farms ha become more specialized in the past decade; however, there a still many farmers involved in mixed farming. A mixed farm one on which two or more different things are produced, f example, livestock and a cereal crop. Grain, corn, or hay th the farmer grows is fed to the livestock on the farm. The farm may also have hens which keep the farm supplied with eggs. vegetable garden supplies many of the vegetables required f daily consumption as well as for canning and freezing.

Economically, mixed farming is wise because a farmer more likely to have something to sell. If the price of be decreases, a farmer may reduce his herd of cattle a concentrate on raising and selling hogs, which may provide more favorable return at that particular time. Later, the farm may rebuild his herd when there are indications that the price beef will increase.

Have the students list advantages of being a farmer. F example, a farmer learns the ways of nature, derives pleasu from watching the crops grow, enjoys eating produce fresh fro the garden, and takes pride in caring for the land and t livestock.

When the students can think of no other advantages, ha them list disadvantages of being a farmer. For example, a farm works long hours and is outdoors in all sorts of weather; a farm must always be ready to tend a sick animal; a farmer often fin it difficult to get help, especially in the busy seasons.

Emphasize how dependent the farmer is on the weather. Ha the students consider the effects on farm crops of too little ra too much rain, lack of sunshine, hailstones, frost, and stro winds.

Seasons on the Farm

Make a large calendar for illustrating farming activities season. The lifestyle of the farmer varies with the season a with the kind of farm. Spring is a planting season, summe cultivating and growing season, fall a harvesting, preservi and freezing season, and winter a planning season.

Discuss that there is never really a holiday for many farme Even though we may think of winter as a time of rest because ground is covered with snow, the farmer with livestock m attend to their needs every day.

The fall is a season for studying canning, preserving, a freezing. The county government offices usually employ a ho economist who may agree to visit your school to talk ab preserving and storing food. Encourage the students experiment with preserving one or more foods, for examp drying apples.

Farm Identification

Many farms have hanging signs at the end of their lanes. sign with a black and white cow indicates that the farm has da cattle (Holstein-Freisan); a sign with a brown cow indicates t the farm raises beef cattle (Hereford or Aberdeen Angus). Century Farm sign shows that the farm is at least one hund

ears old, and a four-leaf clover sign shows that a 4-H Club ember lives there. Encourage the students to report on how any of each kind of sign they passed on a trip in the country.

arm Machinery

Before the invention of the tractor, horses were used to move rm machines. The tractor is the most useful piece of farm uipment because it can be used to pull farm equipment and to ovide a source of power for operating other machines. Have e students research machines used on the farm. Some of these e listed below.

plow	pest control machine	grain dryer
harrow	mower	field chopper
seeder	baler	corn harvester
planter	combine	bean harvester
cultivator	thresher	fruit picker

Have the students try to find pictures of each of the farm achines listed and of other farm machines. Students who are rticularly interested in machines may enjoy describing how me of the machines work. If possible, try to find how much it ould cost to buy the larger machines. Students will likely be mazed when they compare the prices of a combine, for xample, and a car.

-H Clubs

Even though people who live on farms work long hours, there still time for social and community activities. One important rm organization for young people from about ten to twenty ears of age is the 4-H club. The exact age limits vary from rovince to province. The four H's stand for "Head, Heart, lands, and Health". The goals of 4-H are to teach skills that ay help the members in their future careers and to develop ood citizens.

Although 4-H began as a farm organization, it is becoming opular in urban communities. Club members meet once a nonth under the supervision of one or more volunteer leaders. ach member works on a project or a group of members may be nvolved in one project. Often the projects are displayed at a fair nd win prizes.

There are many kinds of 4-H clubs. A club teaching skills that ould be useful on a farm may be organized to work on rticular projects, such as raising a calf, taking care of a horse, lanting a field of grain, growing fruits or vegetables, studying he weather and its effects on farming, sewing and quilting, or ooking and preserving. The kind of club may be influenced by he kind of farming practiced in the area; for example, one might xpect to find potato clubs on Prince Edward Island, beef cattle lubs in Alberta, and forestry clubs in British Columbia.

Have the students pretend that they are planning to form a 4-H lub. Help them plan the organization of the club, considering deas such as the following.

a. what facilities, such as a garden or a barn, are needed
b. what materials are needed, for example, fabric for a sewing project or wood for a carpentry project
c. how long the club will last
d. how often the club will meet
e. where and how the projects can be displayed
f. how the projects can be used after they are completed
g. what the students expect to learn

After the discussion, the students may wish to organize hemselves into small groups and undertake projects that would e beneficial to others in their community.

Theme for Unit 5: Food

Many children nine and ten years of age like to share in the selection and preparation of the food they eat. They have favorite foods and foods they dislike. Learning about nutrition and how nutrients are used by the body will help them appreciate the need for a well-balanced diet.

You can conduct a study of nutrition by following the plan suggested below. You may prefer to choose only one aspect and study it.

A Study of Nutrition

Day 1

Have each student complete a chart similar to the following to show the food he/she has eaten that day.

Food Group	Name of Food You Ate	Size of Serving
Milk and Milk Products		
Meat and Meat Substitutes		
Fruits and Vegetables		
Breads and Cereals		

Students who have never thought about the classification of foods may be surprised to learn that cream soups and cheese are included under milk products. To help them complete their charts, display a list of examples for each food group.

Food Group	Examples		
Milk and Milk Products	milk cheese	ice cream ice milk	yogurt milk pudding
Meat and Meat Substitutes	chicken beef pork	tuna salmon eggs	cheese baked beans peanut butter
Fruits and Vegetables	apple banana orange	peach tomato carrot	cabbage beans peas
Breads and Cereals	bread rolls muffins	crackers cereal rice	macaroni spaghetti noodles

Day 2

Make a chart showing how nutrients from foods in each group are used by the body. Science and health books can be used as resources. You could invite a school nurse to talk to the class about nutrition. A chart similar to the one shown can be used to record findings.

Food Group	Function	Recommended Servings
Milk and Milk Products	provide elements needed for growth and proper functioning of the organs	2 to 3
Meat and Meat Substitutes	provide protein necessary for proper muscle growth and development	2

Fruits and Vegetables	provide vitamins and minerals needed for the growth of bones and tissues and the maintenance of healthy skin	4 to 5
Breads and Cereals	provide vitamin B to help the cells use carbohydrates, fats, and proteins to produce strong bones and healthy skin	3 to 5

Day 3

After the students have examined the needs of the body and the value of the nutrients in each food group, have them plan a menu for one day, keeping in mind the number of recommended servings from each food group.

Breakfast	Lunch	Dinner

Day 4

The cost of food is of concern to most people. After the students have prepared their menus, have them assign a value to each item and then find the cost of each meal. They may need to visit grocery stores or work with other members of their families who are more knowledgeable about prices. Summarize the results in a chart similar to the one shown.

Food Group	Expensive Examples	Economical Examples
Milk and Milk Products	ice cream milkshakes canned puddings	cheddar cheese milk homemade puddings
Meat and Meat Substitutes	salmon back bacon steak shrimp lobster calf's liver	chicken turkey tuna frozen fish peanut butter dried beans
Fruits and Vegetables	avocados out-of-season fruits out-of-season vegetables	apples cabbages carrots potatoes
Breads and Cereals	instant cereals	cooked cereals spaghetti noodles bread rice

Illustrating Nutritious Meals

Have small groups of students prepare menus for five days. Have them draw pictures or cut pictures from magazines and newspapers to illustrate one or more meals.

Pictures may also be chosen to illustrate foods for healthy teeth and gums, foods for healthy eyes, nutritious breakfasts, or snacks for healthy skin.

Food Preparation

Preparing food gives students an opportunity to make judgments about the nutritional value of ingredients, measure the ingredients, and experience the cooking process involved.

Choose from the following recipes or use recipes suggested by the students. Have them prepare food for the class, perhaps for a class party.

Carrot Salad

4 large carrots	a shake of pepper
200 mL seedless raisins	5 mL grated lemon peel
200 mL coarsely chopped peanuts	25 mL lemon juice
2 mL salt	250 mL sour cream

Scrape the carrots and then grate them coarsely into a bowl. Add the raisins, peanuts, salt, pepper, lemon peel, and lemon juice. Mix lightly. Pour the sour cream over the other ingredients and blend.

Peanut Butter Roll

300 mL peanut butter	40 mL soft butter
300 mL icing sugar	600 mL rice cereal

Mix the first three ingredients together.
Add the rice cereal and mix well.
Form into a roll. Wrap in foil.
Chill for about two hours.

Lemonade

250 mL lemon juice	100 mL pineapple juice
500 mL sugar	1 sliced orange
3 L water	1 sliced lemon

Mix the first four ingredients together.
Add the fruit. Serve well chilled.

Graphing

Have students prepare graphs to show their food preferences. These graphs can be used to motivate discussions about reasons for liking and disliking certain foods.

A Class Trip

Plan a class trip to a place where food is being prepared or processed, such as a bakery, a dairy, or a canning factory. Before the trip, discuss the following aspects of the factory.

a. the kind of food prepared
b. where the food comes from
c. how the food is prepared
d. other ways of preparing the food

After the trip, discuss the details of processing the food. Have the students illustrate each step and place the illustrations in a sequence on the display board.

Mathematics in Fruits and Vegetables

Patterns of growth in fruits and vegetables provide interesting studies. Examine with the students ideas similar to the following.

a. what you see when you cut an apple, an orange, or an onion horizontally
b. how many rows of kernels there are on a medium-sized ear of corn
c. how many kernels there are on a medium-sized ear of corn
d. how many peas there are in a pod
e. how many "sides" there are on a banana

For each of these, guide the students in developing a way of attacking the problem. For example, you could have them draw what they think they will see when they cut an apple and then investigate. For a problem that requires counting and recording, have the students prepare charts before starting the investigation.

heme for Unit 6: Collections

Objects usually acquire the label "collection" when they are ganized in such a way that common characteristics are easily ntified. For example, a set of stamps could be organized by te, by country, by subject, by denomination, and so on. milarly, scattered papers with poetry or personal writings may considered a collection once they are organized. Students ay have many things they could organize into a collection, but ey may lack the skills required. Those who wish to start a llection should be encouraged to choose a location and a ethod for storing their collected items and a strategy for eeping the items in place. Cataloging is another skill that llectors find worthwhile. Charts and alphabetical lists are eful tools for recording information about the items.

Students who have collections usually enjoy showing them. If u ask a few students to demonstrate their collections and have e class discuss the presentations, you may find other students terested in starting their own collections.

inds of Collections

The following are some suggestions for the kinds of llections students can make and the kinds of things they can udy while making the collections.

tamps

Students may have stamp collections or they may be able to llect stamps as a group. Stamp collections can be studied nder the following topics.

a. beginning of the use of stamps
b. past and present methods of transporting mail
c. information shown on a stamp, for example, noteworthy persons, historical events, methods of transportation, native plants and animals, culture from the country shown (The stamps on page 132 depict Canadian events.)
d. stamps collected because of their visual appeal

Students may be surprised to hear that at one time the person ho received a letter paid for its delivery. It was not until 1837 hat Sir Rowland Hill devised a system in which the sender paid he postage and attached a stamp to the letter to show that the ostage had been paid.

adges

Many students collect badges that they have earned and crests r pennants bought at places they have visited. Discussing or howing badges received for merit may encourage them to work or other badges. Badges are often earned in the following ctivities.

a. school clubs such as music or mathematics
b. school teams such as baseball or soccer
c. camp activities such as crafts or canoeing
d. swimming tests such as those of the Canadian Red Cross Society or the Royal Life Saving Society
e. organizations such as Brownies or Cubs (Cub badges are shown on page 141.)

oins

Collecting coins is a popular hobby and an easy one to start. Some students who have coin collections may be knowledgeable bout the coins they have collected. Ask them to tell about their collections. Encourage other students to begin coin collections. They could begin by collecting a Canadian penny, nickel, dime, or quarter for each year, or by collecting pennies whose dates show consecutive years. Interest in collections of coins can be developed from a discussion of the following topics.

History

a. the use of beads, salt, tea, grains, animals, shells, or feathers as currency
b. how coins came to be used as currency
c. information about a country shown on a coin, for example, a method of transportation or an historical event
d. reasons for differences in the shapes of coins, such as a rectangular coin or a hole in the center of a coin

Facts About Coins

a. the base-ten system used for the currency of many countries (Some examples are shown on pages 184 and 185.)
b. how coins are made
c. the number of coins minted each year in Canada
d. the number of coins in circulation each year in Canada

Students may be interested in learning about the origin of coins. There were coins made from metal in China about 3000 years ago, but the first coin with a fixed value was used in Turkey in the seventh century B.C. The first Canadian coin was struck in 1670 by Louis XIV of France for his colonies in North America. In 1908, a mint was established in Ottawa so that coins could be produced in Canada.

Cards

Use baseball or hockey cards to motivate discussions or research about the history of the sport or how the game is played.

Photographs

Family photographs are often viewed and stored, seldom to be seen again. Some students may wish to become "the organizer of the family photos". You will likely need to discuss strategies for choosing photographs because viewing several photographs that are the same becomes boring. This kind of project can teach careful judgment as "the collector" thinks about the number of times each family member is included and chooses certain photographs because they are clearer or have better composition than others.

Photographs chosen by theme can also be gathered from magazines and stored in a scrapbook format.

Personal Writings or Art

Many students write in diaries or make sketches, but never store the results. Only much later does it occur to them that a permanent record would be desirable. Mentioning the value of recording personal experiences may encourage the students to keep records that they will value later.

Comic Books

Comic strips began in newspapers in the 1870's. Comic books similar to those published today were printed in the 1930's. They were collections of comic strips previously printed in newspapers. Students may wish to study comic book collections under the following topics.

a. changes in comic books
b. classification of comic book stories as adventure, history, biography, detective, fantasy, science fiction, or mystery
c. a comparison of a comic book and the book on which it is based (When comparing a comic book and a book, discuss any differences in the plot. Ask about similarities and differences in the way the characters are portrayed. Have the students consider whether the pictures in the comic

book make the story more interesting or whether they prefer to visualize the story without pictures.)

d. a comparison of a comic book and a movie that is based on the comic book

Leaves

Leaves include such diverse forms as holly leaves, pine needles, fern fronds, blades of grass, and spinach leaves. Leaves in a collection could be identified by considering the following characteristics.

shape	pattern of veins
size	arrangement on a branch
edges	symmetry

Rocks

Rock collections as well as rocks that are shown and described in books can be studied under the following topics.

a. identification of rocks that the students have collected and the rocks shown on page 145
b. how rocks are formed
c. where rocks are found
d. the use of particular rocks
e. the value of particular rocks
f. words for describing rocks

You may wish to discuss three main groups of rocks, using pictures or diagrams to illustrate their differences.

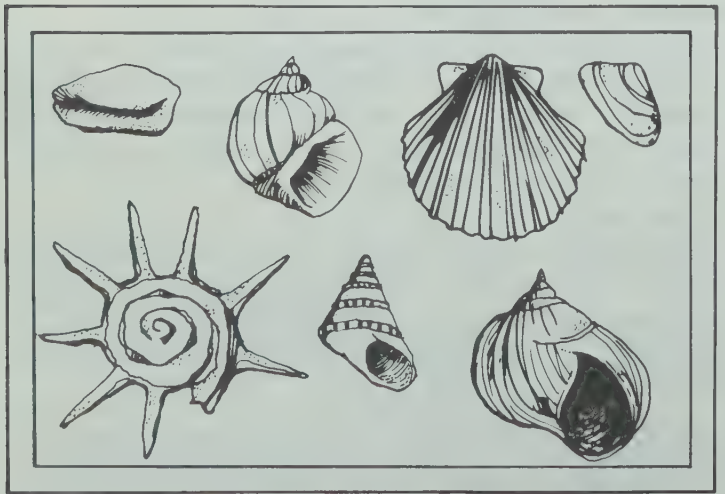
Igneous rock is formed from material that was so hot that it was liquid. Igneous rocks form the base of the continents. They are under all other rocks, but have been exposed in some places. Lava and granite are examples of igneous rocks.

Sedimentary rock covers most of the earth's surface. Some sedimentary rocks are worn away and deposited at the bottom of bodies of water. Sandstone and limestone are examples of sedimentary rock.

Metamorphic rock is rock that has been changed by pressure that has bent or folded the rock or by heat that has melted the rock. An example of metamorphic rock is marble.

Other Collections

Students may have or be interested in beginning other collections such as post cards, pictures, bottles, miniatures, banners, or shells.



Activities Related to Collections

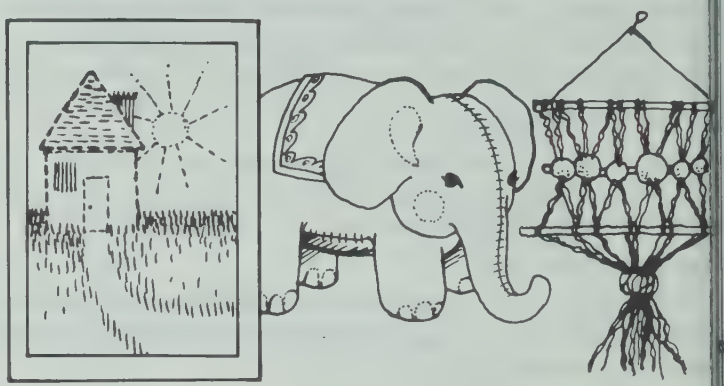
Collections can be the basis for activities while the students are preparing the collections and also after the collections have been completed.

Collecting Items

As a project, have the students begin a collection or continu with a collection that has already been started. Have them wor individually, in small groups, or as a class. It may be possibl for each student to be working on an individual project at th same time that a class collection is being prepared. The clas could make a collection of their favorite songs, poems, o stories. The pages could be copied, bound, and indexed fo distribution to each student, others in the school, and parents You may wish to have some students learn to use a typewrite and play the role of production manager for such a project.

Making Items for a Collection

Craft and art collections are things that small groups or classe can work together to produce. Have each student create an iten during an art lesson. Some students may have crafts made a home that they would like to contribute to the collection.



Imaginary Collections

For some collections, especially imaginary collections, th events involved in collecting objects rather than the collectio itself may intrigue students. Have the students write a story o draw a sequence of pictures about collecting unusual items, such as rocks from another planet or plants from a jungle.

Writing a Guide About Collecting

Have each student prepare a guide for one kind of collection If each student is collecting something, the guide may be a project that accompanies the collection. If the students are no preparing a collection, the guide may be about a collection tha has already been started or one that interests the student. Have them include the following features in the guide.

a. a cover
b. a title page
c. a table of contents
d. facts pertaining to the item collected, such as historical o geographical information
e. details about collecting, for example, where and how the items are found and their cost
f. instructions about preparing the items for the collection
g. instructions about storing the collection
h. a bibliography of books to read about that kind of collection

Building Vocabulary

Have the students prepare dictionaries for words pertaining to a particular kind of collection, such as rocks. The dictionary may consist of a page for each word. On each page, have the students show the word, the word in syllables, how to pronounce the word, a definition written in the student's own words, a sentence using the word, and an illustration, if possible. Each

udent could make a dictionary or contribute one or more tries to a class dictionary.

terviewing

Arrange television interviews with students who have a real or imaginary collection. Present three or four interviews each ay as a television program. A master of ceremonies and a time mit for each interview may help to organize the program.

a. Have students bring collections to school and be interviewed by other students. The interviewers should prepare questions in advance. This will require research on the kind of item collected as well as a discussion about how to conduct an interview. If each student has made a collection as a school project, each could be interviewed.

b. If the students do not have collections, arrange the interviews to include the entire class. Divide the class into pairs of students consisting of an interviewer and one to be interviewed. Each pair would then select a kind of collection. Encourage imagination for the choice of collections, which could include items that would be impossible for nine-year-olds to collect, such as antique cars. To avoid identical collections, keep a list of the choices as they are made. Then each member of the pair would research the topic, but would not discuss it until the interview. The interviewer would prepare questions relating to the collection and reflecting a knowledge of it. The one being interviewed would find out information that the collector would be expected to know.

laying Games with Collections

Some collections, such as marbles or hockey cards, can be sed for games. Have each student create a game and teach it to nother student. You may prefer to have each student create a ame and write the rules for the game as a creative writing esson.

reating Problems with Collections

Use collections for creating and solving problems. For example, using hockey cards would help to explain the problem on page 135. Have students create similar problems with other groups of hockey cards or with baseball cards. Have others solve he problems and use the cards, if necessary.

Displaying a Collection

Display an art collection on a bulletin board or on a table. Collections mounted on Bristol board can be stapled to a bulletin board or displayed on a ledge. The display cases in the front hallway of the school or of the Board of Education offices can be booked for displaying collections. Administrators are usually eager to fill the cases with students' work.

Place booklets about collections on a book shelf or in a reading center. By reading about or looking at collections, students can learn from the work of others.

Collecting Items on a Class Trip

Plan a class trip to a park or a conservation area to find items, such as leaves, for a collection. Have the students classify the leaves and arrange a class collection.

Viewing a Collection

Arrange a class trip to a place with a collection on display. After preparing or studying a rock collection or a stamp collection, students may enjoy seeing one in a museum. There may be a collection of a particular kind of antique or an art collection at a museum or an art gallery the class could visit.

Theme for Unit 7: Geometry Around Us

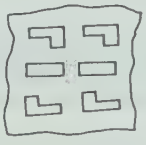
A study of geometry helps us to understand and appreciate our environment. We are surrounded by geometric shapes in nature, and our man-made environment is based on many designs copied from nature. If the students are encouraged to observe geometric forms and principles in plant and animal life as well as in architecture, design, and art, their interest in geometry may be increased. It is from real-life examples that they will understand, appreciate, and extend the geometry they have studied.

Discovering Geometry

Symmetry is defined as the correspondence in size, form, and arrangement of parts on opposite sides of a point, line, or plane. Thus, a study of symmetry is a study of balance. The study of symmetry in nature, construction, design, or art can provide examples of motion geometry. Examples that suggest slides, flips, and turns are given in the following chart.

Slides	the floor plan of a hotel or an apartment building designs on wallpaper or fabric a boat moving across water a sliding door
Flips	apples cut in half vertically an open notebook your image in a mirror the wings of a butterfly
Turns	the blades of a propeller the hands of a clock a revolving door the spokes of a wheel

One way to begin to describe the properties of slides, flips, and turns is to discuss the patterns that appear in objects and to determine how they were created. Have the students prepare a chart similar to the following.

Object	Pattern	Physical Action	Motion Suggested
apple		cut the apple in half vertically	flip
orange		peel the orange and separate the segments	turn
design on fabric		make a pattern by moving the fabric and printing the design again	slide
notebook		open the notebook	flip
revolving door		push the door	turn

Finding and Creating Examples of Geometry

Have the students work in groups to find or create six items illustrating motion geometry in the following ways.

a. a photograph showing a slide (flip or turn)
b. a drawing showing a slide (flip or turn)
c. a poem written about a slide (flip or turn)
d. a model of an object that slides (flips or turns)
e. a sample of wallpaper or fabric that illustrates a slide (flip or turn)
f. a logo created by sliding (flipping or turning)

A *cinquain* (sĭng kān′) is a five-line poem. Each line has a special purpose.

First line — one word giving the title
Second line — two words describing the title
Third line — three words describing an action
Fourth line — four words describing a feeling
Fifth line — another word for the title

This is an example of a cinquain.

Flip
Upside down
Walks on hands
In a different world
Change.

Have the students try to write a cinquain for a slide (flip or turn).

Examples of Geometric Ideas

Have the students list as many examples of geometric ideas as they can. For a game, divide the class into teams of five members. Each team should have paper and a pencil for the team "recorder". In three minutes or whatever time limit seems appropriate, each team lists as many examples as possible of a specific aspect of geometry, such as slides, flips, turns, or symmetric shapes. The team that records the most examples is the winner. After the game, display the lists for reference.

Making Geometric Designs

For constructing designs, students may cut a particular shape from construction paper. They may trace around the cutout again and again, flipping, sliding, or turning the cutout to create an interesting design.

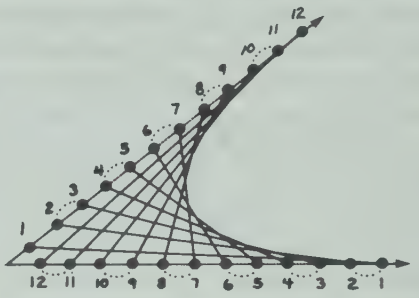
Another way to make a design is to use "stamps" cut from vegetables such as potatoes, carrots, or turnips. The edges of a cross section of a potato, for example, can be cut away to make a simple shape. The "stamp" can be dipped in paint and "printed" on a piece of paper. According to the position of "printing", patterns can be made to illustrate slides, turns, or a combination of the two motions. Display the students' designs in groups according to whether the design was created by using slides or turns.

Have the students cut several congruent geometric shapes from construction paper. Have them arrange the shapes to show slides, flips, and turns and then glue the shapes on another piece of construction paper.

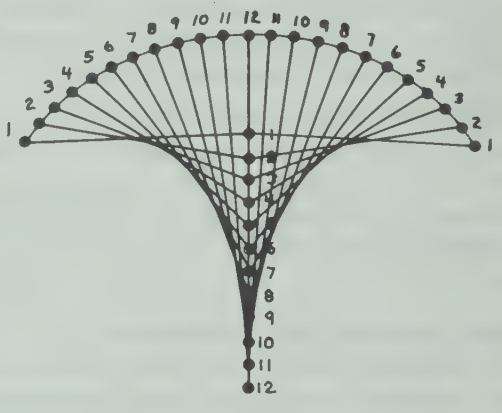
Curve Stitching Patterns

Colorful geometric designs can be made with thread, or yarn, and Bristol board. Each stitch is straight, but the design that is created appears curved. The following are two of the methods for curve stitching.

a. Mark equally spaced dots on the rays of an angle. Mark th same number of dots on each ray. Number the dots a shown. Stitch with colored thread, or yarn, to join the do in the sequence $1 \rightarrow 1 \rightarrow 2 \rightarrow 2 \rightarrow 3 \rightarrow 3 \rightarrow 4 \ldots \rightarrow 1$ $\rightarrow 12$. If the stitching is done correctly, there will be curved pattern on one side of the Bristol board. On th opposite side there will be a row of loops as shown in th diagram at the right.



b. Mark equally spaced dots and number the dots on an arc c a circle and a line segment as shown below. Stitch from th arc to the line segment to join equal numbers; that is, $1 \rightarrow$ $\rightarrow 2 \rightarrow 2 \rightarrow 3 \ldots$.



Half the dots on the arc will have been used when all th dots on the line segment have been used. Continu stitching from $12 \rightarrow 11 \rightarrow 11 \rightarrow 10 \rightarrow 10 \ldots$ until all th dots on the line segment have been used again in sequence to finish stitching the dots on the arc.

Mobiles

Have the students create mobiles consisting of three dimensional geometric shapes. The shapes can be made wit straws, pipe cleaners, toothpicks, or construction paper and th patterns on pages T 357 and T 358. Three or four students ma make the shapes for one mobile.

Physical Education

The students' understanding of slides, flips, and turns can b reinforced during a gym class. Give the instruction "Slide", an have the students move to demonstrate a slide. Repeat this wit "Slide", "Flip", and "Turn" in random order.

Have each student prepare a gymnastic routine based on combination of slides, flips, or turns. Divide the class int groups with about six members. Have half the members of each group show their routines to the other half of the group. Ther have those who were watching identify some of the motion used for the routines. Repeat this procedure for the other half o each group.

Theme for Unit 10: Transportation

The photographs in this unit depict various methods of transportation used by Canadians from coast to coast. The photographs were taken in locations from east to west as indicated in the following chart.

Pages	Method of Transportation	Location of Photograph
228	bus	Newfoundland
230-231	ferry	Nova Scotia
233	airplane	Fredericton, New Brunswick
234	subway	Montreal, Quebec
235	horse	Montreal, Quebec
236	tour boat	St. Lawrence River
238	elevator	Toronto, Ontario
240-241	car	Prairies
242	train	Rocky Mountains
244	sight-seeing bus	Victoria, British Columbia

Students will likely be eager to tell about their experiences involving transportation during holiday trips. Canoeing, bicycling, and hiking are more active forms of travel and should be recognized if they are mentioned in a discussion.

Projects on Transportation

Have the students prepare projects about various aspects of transportation. The projects may include written information and illustrations that the students draw or cut from magazines or newspapers. If students select a variety of topics, the results may be interesting and informative reading for the class.

If your students have access to audio and video tape recorders, build the projects around the use of such equipment. A sight-seeing tour taped from the school bus or from the family car on a short trip in the neighborhood may make students more aware of their environment.

The reading and preparing of graphs showing the number of persons traveling to various places or the number of persons traveling by different methods of transportation would make interesting activities.

The following suggestions may lead to other ideas that will be of interest. Encourage the students to suggest possible topics.

Early Transportation

Students may write about methods of transportation such as walking, donkeys, reed boats, or chariots. They could compare early transportation in different parts of the world, or they could describe the history of transportation. Students may be interested in learning that between 6000 B.C. and 3500 B.C. camels, horses, and oxen began to be used for transportation and sails to be made for boats. About 3000 B.C. the wheel was invented in southwestern Asia. Chariots were used in Egypt about 1675 B.C. Another point for consideration is that early civilizations began along waterways because water transportation was the easiest method.

Transportation of the Explorers

Projects could be based on a group of explorers such as the Vikings or the explorers from Spain. Another possibility would be to study the travels of a particular explorer, such as Leif Ericson, Marco Polo, Christopher Columbus, John Cabot, Vasco Da Gama, Jacques Cartier, or Henry Hudson. For these projects, students may write about the travels of the explorers, or keep a daily account for one month or more in which they record information about the methods of transportation that were used, the supplies that were packed, the reason for most explorations being by water, the equipment, the places that were visited, and the difficulties that were encountered. The routes of the explorers may be shown on maps and pictures can be drawn of the ships that were used. Students may be surprised to discover the length of time required for the voyages.

Transportation of the Pioneers

Others in the class may be interested in studying the pioneers' methods of transportation. Lifestyles and customs of early settlers provide intriguing stories, particularly for students whose ancestors were in Canada in the 1800's. The influence of the terrain on the trade routes, on the choice of vehicles for transportation, and on the location of the first settlements may be discussed. The first roads in Canada could be compared with the roads today.

Transportation on Land

Projects may be about one vehicle of transportation or about several different vehicles of transportation. Subways in cities is another possible topic. Such a study may include the growth of subways, their use, their organization, features of subway trains, and maps showing subway routes.

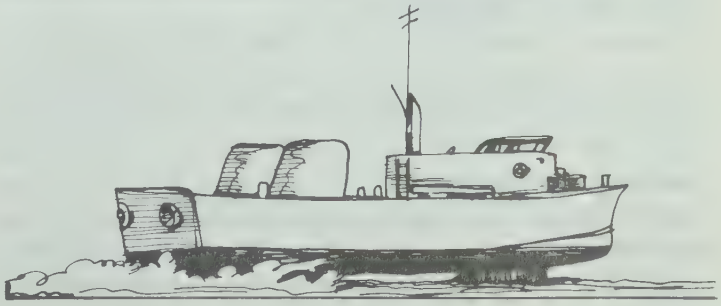
Students could write about trains or buses. This may involve the routes, the schedules, the cost of operating a train or bus, the cost for the passenger, the locations of stations, and kinds of trains or buses.

Transportation on snow and ice is a possible topic that may include sleds, snowmobiles, snowshoes, skis, and skates.

Transportation on Water

Some students may wish to study water transportation in general. Other students may prefer to write about boats that have a certain kind of power. These could be steamboats, sailboats, boats powered by gas, or boats such as canoes, rowboats, kayaks, and gondolas that are propelled by human energy.

Students may enjoy researching the hovercraft or the hydrofoil. The hovercraft has a cushion underneath it that inflates like a balloon for traveling across water. It is used to cross the English Channel. The hydrofoil is a craft that rises a few feet above the water after it has gathered sufficient speed. It is then supported by devices that are similar to wings.



Other topics related to water transportation are the ports of Canada, the ports of the world, and shipping routes. These projects may include maps showing the locations of ports, diagrams of the ports, information about the organization of a port, and activities at a port. Projects about water transportation would probably include the influences of weather and ice.

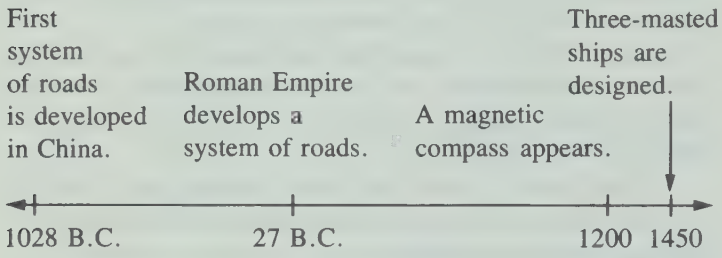
Transportation in the Air

Students could research facts about various kinds of air transportation. They could either compare a few of them or concentrate on only one kind. Airplane routes and airports may be part of a study on airplanes or they may be a separate study.

Students may enjoy studying about the use of balloons for transportation in the past and in the present.

History of Transportation

Students may become involved in a general assignment about the history of transportation in various parts of the world from the earliest known transportation to the present or about the history of transportation during a certain era. The transportation could be related to life at a particular time. Simple maps would show the locations of the events. A time line similar to the following could be used to show the events in order.



The development of a particular kind of transportation such as trains, steamboats, or airplanes may interest some students as a topic for a project.

Fantasy and Space Travel

Fantasy can be included by having the students create a model of a space vehicle or write stories about the methods of transportation they think they would use in space.

Transportation in Other Cultures

The methods of transportation used by various cultures provide a topic for study in social science classes. Some students may be surprised to learn that many Bedouins still travel with camels and some Mennonites use horses for working their farms and for traveling about their communities.

Purposes of Transportation

The main purpose of transportation is to carry persons or goods from one place to another. Students may be interested in investigating the pipeline as a method of transportation or how some methods of transportation are adapted for people, for freight, or for both.

Difficulties in Transportation

Mountains, jungles, deserts, ice, waterfalls, rapids, oceans, and storms cause difficulties in transportation. Students may investigate one or several difficulties and the ways that they are overcome.

Traveling in Canada

Have students locate each place mentioned in Unit 10 on a map. Ask what they can learn about each location or how they can identify the location from the photograph. Students who have been to a particular place may tell about their experiences. Students may be able to find other pictures of some of the places and then compare the pictures.

Help the students plan a trip. They may plan a trip as a class or they may be able to plan different trips in groups of four persons. A map and schedules for planes, buses, and trains may be used. Ask questions such as the following.

"Where would you go?"

"In what order would you visit these places?"

"What routes would you use?"

"How would you travel?"

"Would you use the same method of transportation for the entire trip?"

"How would you follow the schedules?"

"What would you do at the places you visit?"

Comparisons

Name two kinds of transportation, such as boats and trains, helicopters and airplanes, or sailboats and rafts. Help the students compare them. Ask for ways they are alike and for ways they are different. Point out that a comparison involves both similarities and differences. Then have the students complete the comparison individually or in small groups. Later students may wish to compare two other kinds of transportation. Comparisons written on chart paper may be displayed.

Graphing

Have the students draw graphs related to transportation. If these graphs are displayed, other students can write and solve word problems that require interpreting the graphs. Many topics such as the following may be used for graphs. Encourage the students to suggest other possible topics.

a. the maximum number of passengers for various vehicles of transportation, such as different kinds of airplanes
b. the length of time required to travel between two particular cities by different methods of transportation
c. the cost of traveling between two particular cities by different methods of transportation
d. the number of students who have used various methods of transportation
e. the favorite methods of transportation of the students

Problem Solving

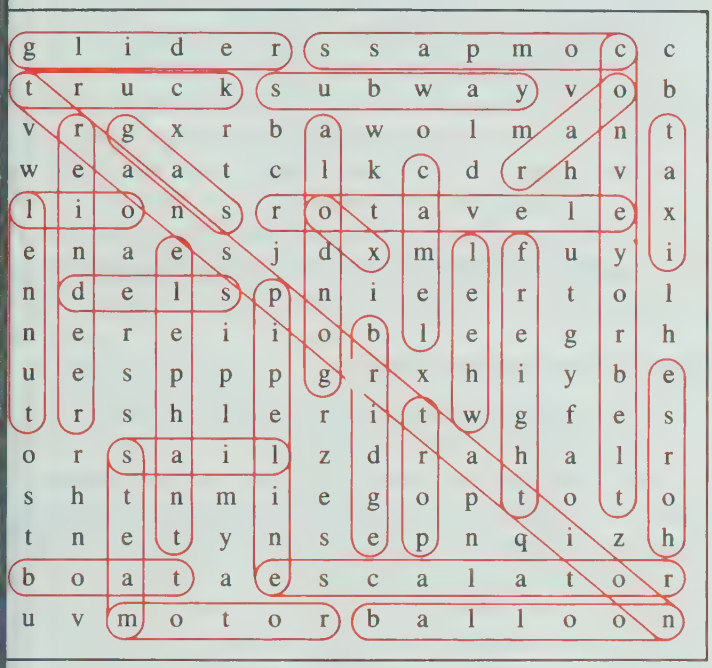
Have the students create word problems about transportation and solve their own or those of others. Students may write problems and submit them to be written on cards for a problem-solving box, or the problems may be exchanged. You may prefer to create word problems for the students to solve. The following may suggest ideas for word problems.

a. the photographs in Unit 10
b. the word problems in Unit 10
c. graphs that the students prepare about transportation
d. reports on transportation
e. distances traveled
f. the number of passengers using a transportation vehicle
g. the cost of traveling
h. schedules for airplanes, trains, or buses
i. finding routes on a map for a particular destination or finding the destination for a given route (These may be similar to *Problem Solving* on page 241.)
j. finding destinations or giving directions for routes to places that the students know

ocabulary

Words relating to transportation are written forward, backard, up, down, and diagonally in this puzzle. Have the udents search for the following words.

balloon	gas	reindeer
boat	glider	sail
bridge	gondola	sled
camel	horse	steam
compass	motor	subway
conveyor belt	oar	taxi
elephant	oil	transportation
elevator	ox	truck
escalator	pipeline	tunnel
freight	port	wheel



Have students write word search puzzles similar to this one or others to solve. They may use words relating to transportaon from their projects or from their research.

reative Writing

Show a picture or a few pictures to inspire the students to rite stories about transportation. You may prefer to suggest pics similar to the following.

a. Transportation in the Future
b. The Method of Transportation I Used as an Explorer
c. My Experiences Using Transportation (real or imaginary)
d. A Forgotten Method of Transportation
e. My Experiences as a Car (or another method of transportation)
f. My Log (for a sea voyage)

rama

Have the students perform impromptu plays in which they use ehicles of transportation, operate vehicles, or work in the ontrol booth at a train station or at an airport.

rt

Use the theme *Transportation* for an art lesson. For example, ave the students create a collage. Each student could draw a icture of a different vehicle of transportation. Encourage them o find unusual vehicles such as gondolas, hydrofoils, or reed oats. The vehicles may be organized into a collage according to ater transportation, air transportation, and land transportation.

Theme for Unit 11: Sharing Experiences

This theme can be used to reinforce the sharing concept of division when the number of students working on a project is known and the individual tasks are to be divided so that the students share the responsibilities. Help the students develop various ways for recording the tasks involved and for deciding how the tasks can be shared.

Sharing Tasks at Home

The following example shows how Bobbie, Chris, and Petra share four jobs in their home each week.

Sharing Tasks in the Eagle Home

Day	Prepare Food	Wash Dishes	Collect Garbage	Care for the Pets
Mon.	B	C	P	B
Tues.	C	P	B	C
Wed.	P	B	C	P
Thurs.	B	C	P	B
Fri.	C	P	B	C
Sat.	P	B	C	P
Sun.	B	C	P	B

After tasks have been defined and work is in progress, it may appear that one member works longer than another. Have the students determine whether this is the case in the Eagle family. Assign one hour each day for the task of preparing food, one-half hour for washing dishes, and one-quarter hour each for collecting the garbage and caring for the pets.

Have the students discuss reasons for the differences in the amount of time each person is required to help in the home.

Sharing Tasks at School

Have the students grow a garden in the classroom or in the schoolyard. Planting the garden and caring for it provide experiences in sharing responsibilities. In the planting stages, the suitability of the soil, the accessibility of light, sunshine, water, and drainage must be considered. In the growing stages, proper and constant care is essential.

Students may wish to experiment with different seeds from fruit. Avocado and grapefruit seeds can be grown successfully in the classroom. Begonia and philodendron plants can be started by placing a leaf in water until roots begin to appear. Beans, tomatoes, parsley, and chives can be grown in the classroom.

Hydroponics is a way of growing plants with no soil, only nutrient solution. This may be a method of gardening which you can initiate for science experiments on plant nutrition.

Sharing Tasks in the Community

A bake sale can be organized by a few, but the cooperation of the entire group is necessary if there is to be enough to sell. The work should be divided so that each member of the group participates in the preparation before the sale or in the work on the day of the sale.

The organizers will have to consider such things as setting a date for the sale, preparing a list of those who can bring food, advertising the sale, finding tables to be used for the event, having sufficient money for making change on the day of the sale, and arranging for students to act as sales help during the sale. If the students are to appreciate the amount of organization necessary for such an event, they should be involved in it.

Extra Materials

Pages T 345 to T 370 include materials that have been referred to in the teaching suggestions for various lessons. Although suggestions for using many of these materials are given in the related lesson outlines, other suggestions for some of the materials are given below.

The addition table on page T 349 and the multiplication table on page T 350 may be used in mastering basic facts. As facts are memorized, students may color inside the appropriate squares on copies of these pages. By folding a copy of each table along the appropriate diagonal, students may observe that numbers on one side of the diagonal match numbers on the other side. Students may search for patterns in the tables, for example, even numbers, odd numbers, multiples of five, and square numbers. The tables are useful in demonstrating the commutative properties of addition and multiplication, and in relating inverse operations (addition and subtraction, multiplication and division).

The shapes on pages T 353 to T 356 may be used for making attribute blocks (see page xxiv) since the actual size is shown. The large circle is a suitable size for making individual number spinners. The triangles, rectangles, and squares also lend themselves for work with fractions since their dimensions are such that four of one small shape exactly cover the corresponding large shape.

The patterns for the three-dimensional shapes on pages T 357 and T 358 are marked with recommended dimensions. You may find it easier to construct some of these shapes if the pattern is outlined first on squared paper (page T 367), using the centimetre grid lines as a guide.

Because the number lines on page T 359 are marked into centimetres and half centimetres, copies of several of these may be pasted together to make "metre tapes" for the students to use in their measuring activities. Copies of the line which is marked in millimetres are useful in measuring small lengths and in relating millimetres and centimetres.

Copies of the 10-by-10 grid on page T 361 may be used for preparing individual game boards or work sheets for activities. The 11-by-11 grid may be used for preparing tables of basic addition or multiplication facts.

Copies of page T 362 will be suitable for preparing models of hundreds, tens, and ones for the students. These may be prepared by pasting the cutouts on cardboard, laminating the surface (optional), and then cutting the models apart as desired.

To make models for thousands, ten single models of hundreds may be stapled or taped together to represent one thousand.

Copies of page T 366 may be used in many different ways. Some suggestions are as follows: for activities similar to those in Ex. 5 to 12 on page 77, Ex. 1, 4, and 6 on page 78, and Ex. 4 on page 79; for reinforcement for pages 212 and 213 (dots are joined to form a simple shape and then the students find the perimeter of the shape); for reinforcement for pages 216 to 219 (dots are joined to form a simple shape which the students color and then find its area); for providing arrays for which the students write the multiplication or division sentences; for students to show the size of the arrays for given multiplication and division sentences.

Copies of pages T 367 and T 368 may be used for activities involving slides, flips, and turns; line symmetry; bar graphs, line graphs, and coordinate geometry (naming points on a grid).

Teaching Aids, Activities, and Games

Peg Abacus

A simple peg abacus can be made from a Styrofoam tray three wires of equal length cut from coat hangers, and plaster o Paris. Fill the tray with a mixture of plaster of Paris. Before sets, insert the three wires and then allow the plaster to set. Us objects (colored wooden beads, washers, or empty spools) fo representing numbers. The wires should be about 5 cm lon unless empty spools are to be used, in which case they should b about 30 cm long.

A sturdier peg abacus may be made using wooden dowels on wooden base. It is important that students view the abacus fro the same side and not from opposite sides, which would result i a reversal of the place values.

To show numerals with up to six digits, place one abacus t the left of another.

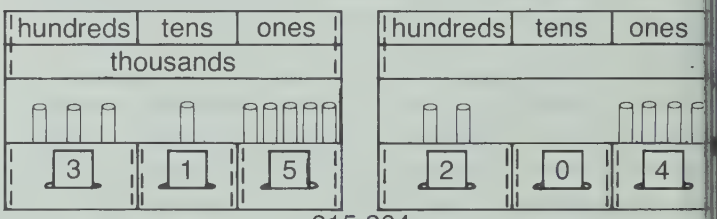
242 031

Place-value Pocket Chart

Pocket charts for demonstrating place value may be made in variety of ways. One of the simpliest forms is illustrated below.

Bristol board or thick plastic is cut in one piece, folded, an stitched or stapled where indicated to make three pockets fo working with hundreds, tens, and ones. Slits may be made in th pockets to accommodate numeral cards for showing the standar numeral for the number of hundreds, tens, and ones displayed.

This chart may be fastened to the display board or othe convenient location. For showing numerals with up to si places, one pocket chart may be placed beside another.



315 204

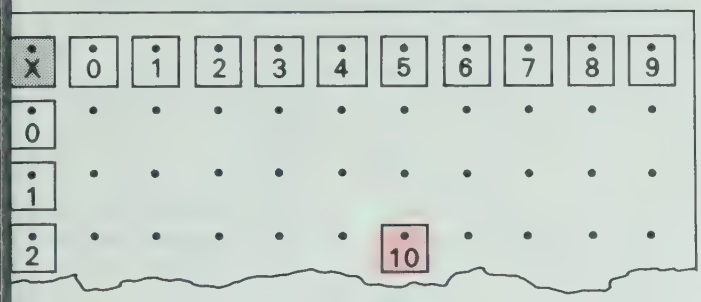
Elevator Beads

This is a convenient device for students to use for countin and for illustrating number facts, because the beads may b pushed along the string to stay in certain positions.

Select 25 beads of one color and 25 of another color. Cut piece of string more than twice the length of the 50 beads, bein certain to provide plenty of slack. Fold the string in half and a the folded end tie a knot for a finger loop. Thread the two end of the string through each bead with each of the two strand going through the hole from opposite sides. Continue to plac the beads on the string, alternating the colors, until the 50 bead have been used. Leave some slack at the end and tie two knot for a finger loop.

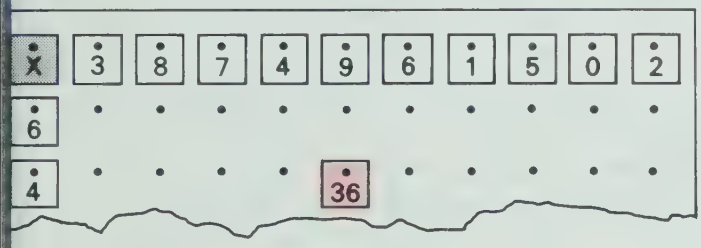
umber Board

A number board showing a multiplication table is a useful evice for students to practice the basic facts.



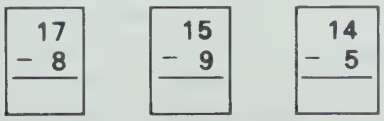
Obtain a piece of plywood that is 60 cm by 75 cm and about cm thick. Place 121 nails (or hooks) at 5 cm intervals in a quare array, forming eleven rows with eleven nails in each row. eopaper (copies of page T 366) may be taped to the board to sist in placing the nails. Prepare 20 numeral tags of one color r factors (2 for each of the numbers 0 to 9), 100 tags of another olor for products, and 1 tag of a third color for the symbol ×. unch each tag with a hole for hanging from the nails. When the ctor tags and the operation tag are in place, have students hc ng the tags for products. Leave the board on display for ference.

As basic facts are mastered, the corresponding product tags ay be turned with the blank side out. As a further challenge, e order of hanging the factor tags may be changed.



ubtraction Relatives (Activity for pages 54 and 55)

laterials: 10 library book pockets marked with the numerals 0 to 9;
a set of cards (which fit the library book pockets) for basic subtraction facts.



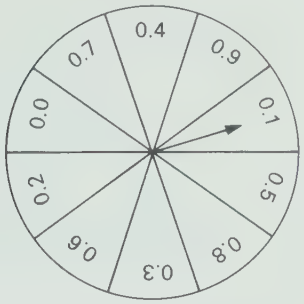
layers: three to five

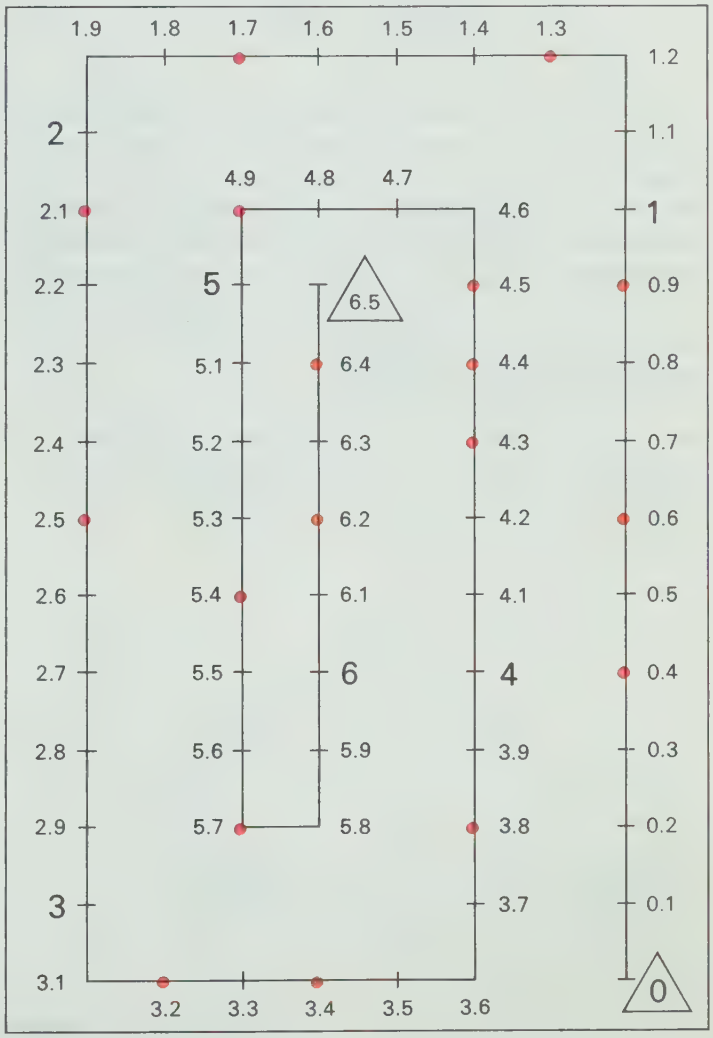
ules:

. The cards are shuffled, and each player is dealt three or four of them.
. The first player displays one of her/his cards and places it in the appropriate pocket for the correct difference. The player then asks, "Who are my relatives?"
. All players who have basic subtraction fact cards for the same difference place them in the pocket.
. If no player has a "relative", the second player begins the next round.

Round It (Game for pages 198 and 199)

Materials: a number spinner for decimal tenths from 0.0 to 0.9;
a game board similar to the one shown;
a marker for each player.





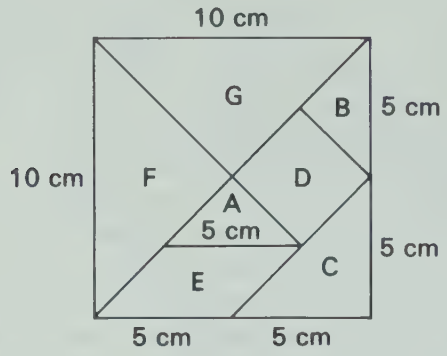
Players: two to four

Rules:

1. The markers are placed at 0 to start the game.
2. Each player, in turn, spins the spinner and advances her/his marker the number of tenths shown.
3. If the number reached on the game board is marked with a red dot, players round the number to the nearest whole number and move their markers accordingly. For example, a player whose marker lands on 3.8 rounds the number to 4, and the marker is advanced to 4. A player whose marker lands on 3.4 rounds the number to 3 and moves the marker back to 3.
4. The first player to reach 6.5 wins the game.

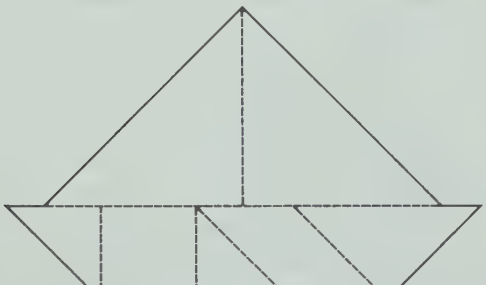
Tangrams (Activity for pages 218 and 219)

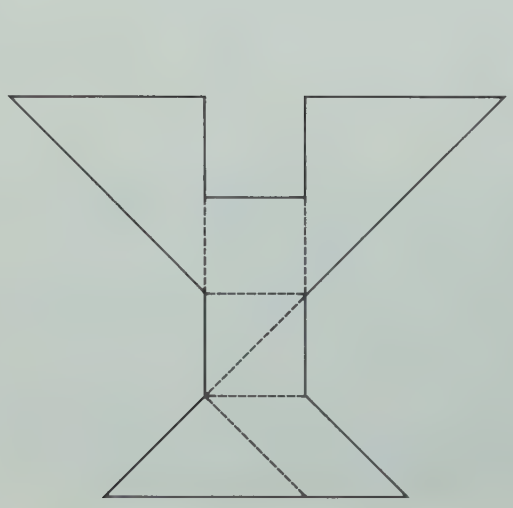
Mark copies of the decimetre squares on page T 363 to show the seven parts as indicated below.



Have each student paste a marked square on cardboard and then cut it into the seven parts. Have the students manipulate the shapes to discover relationships among them. For example, triangles A and B may be placed to cover triangle C (square D, parallelogram E), and thus, the area of triangle C is twice that of either triangle A or triangle B. When other similar relationships have been discovered, the students may be able to answer questions such as, "How many of triangle F (C, A) would be needed to cover the large square?"

Have the students reassemble some or all of the seven parts to show different shapes. If they trace around their shapes, they may exchange papers and try to make their tangram pieces fit the new shapes.



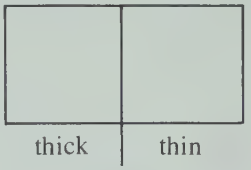


Attribute Challenges (Activity for page 248)

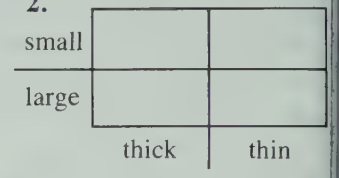
A description of attribute blocks is given on page xxiv Prepare activity cards similar to the following and have th students work in small groups with the blocks.

Sort the blocks.

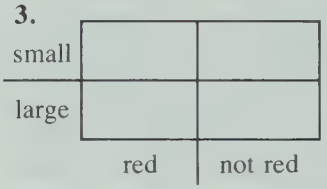
1.



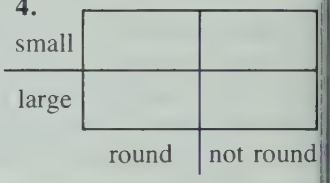
2.



3.



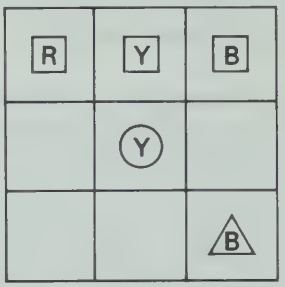
4.



Copy and show blocks to complete the patterns.

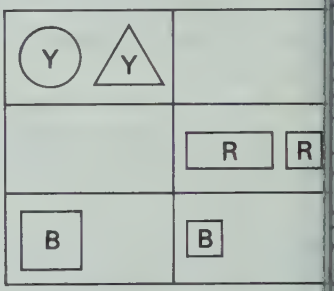
Y: yellow B: blue R: red

5.



(thin blocks only)

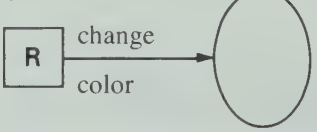
6.



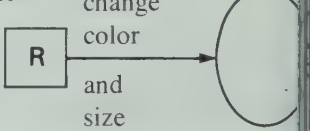
(thick blocks only)

Start with a large, thin, red square each time.
Show which shapes can be placed in the ring.

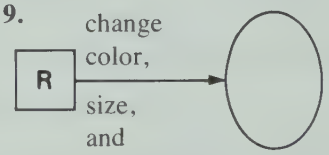
7.



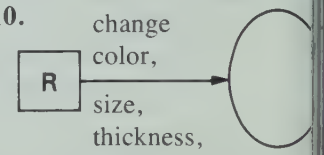
8.



9.

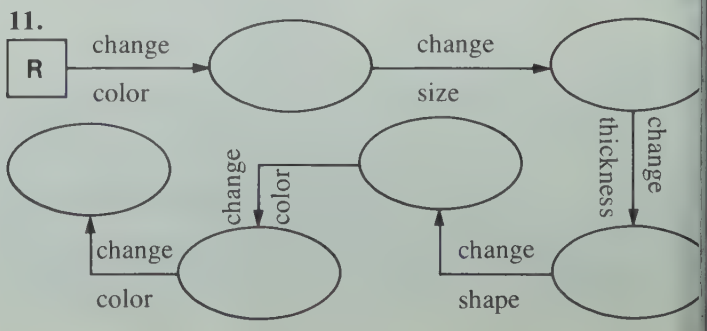


10.



Join "cars" to complete the "train".
Start with a large, thin, red square.

11.



vestigating Prime Numbers (Activity for page 252)

Provide each student with a copy of page T 361 and have them tline the diagram to show a 10-by-10 grid. Have them write e numerals 1 to 100 in order in the appropriate squares. Then struct them to mark squares as follows (using a different color r each symbol, if desired) and observe the patterns.

The steps describe a procedure known as the sieve of atosthenes.

Ring the numeral 2. Mark a diagonal (/) through the other multiples of 2 (4, 6, 8, . . ., 100).

Ring the numeral 3. Mark a diagonal (\) through the other multiples of 3 (6, 9, 12, . . ., 99).

Ring the numeral 5. Mark a triangle (△) around the other multiples of 5 (10, 15, 20, . . ., 100).

Ring the numeral 7. Mark a dash (—) through the other multiples of 7 (14, 21, 28, . . ., 98).

Ring all the remaining numerals with the exception of the numeral 1.

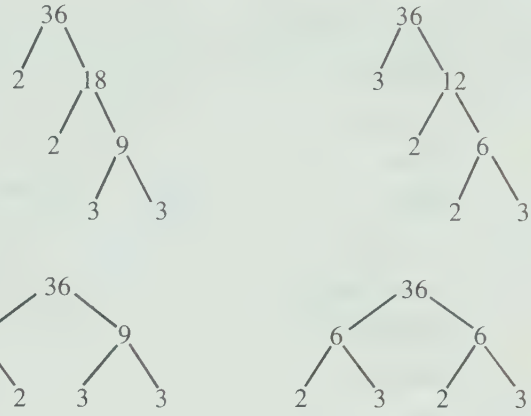
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Recall that a prime number is one that has exactly two ifferent factors. Thus, the number 1 is not a prime number. You may wish to have the students color inside the square for he number 1.) All numerals marked with a ring represent prime umbers. The remaining numbers (with the exception of 1) are omposite numbers. Have the students note the location of prime umbers. Have them discuss whether there is a pattern.

The students may write each prime number as a product.

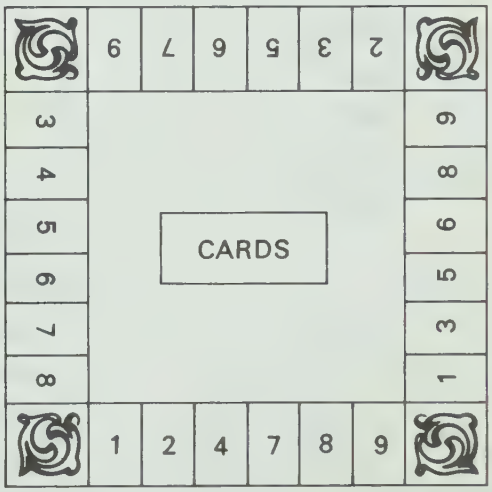
$2 = 1 \times 2$
$3 = 1 \times 3$
$5 = 1 \times 5$
$7 = 1 \times 7$
$11 = 1 \times 11$
$13 = 1 \times 13$

If the students are currently working in Unit 11 and have attempted the *Try This* feature on page 252, you may have them select one or more composite numbers as shown on their 10-by-10 grid and show a factor tree to derive the prime factors. For some numbers, the factor tree may be drawn in more than one way.



Car Park (Game for pages 254 and 255)

Materials: markers to be used as "cars" (6 for each player);
a set of cards showing basic division facts;
a game board, similar to the one shown, with parking spaces large enough for the cars to "park".



Players: three or four

Rules:

1. Each player chooses a parking lot (one side of the game board) and six cars.
2. The first player turns over a card. If the answer appears in her/his parking lot, she/he parks a car on the space. For example, a card showing $72 \div 8$ indicates that a car is to be parked on 9. If the answer does not appear on her/his parking lot, the player places the card at the bottom of the pile and the next player has a turn.
3. The second player turns over a card and the game continues.
4. The player whose parking lot is filled first is the winner. (A completed multiplication table, as shown on page T 350, may be available for reference in cases of disagreement.)

Words in the puzzle on page 2

fraction
Roman numeral
numeral
second
circle
more
odd
temperature
rectangle
less than
flip
week
square
centimetre
cent
metre
month
may
year
earn
sum
one
pentagon

subtract
subtraction
quarter
two
dozen
odd
minus
day
millilitre
litre
half
symmetry
seven
dime
ten
difference

similar
area
cone
nine
nineteen
number
number line
line
line segment
segment
ruler
decimal
decimal point
point
multiplication
sphere
nickel
octagon

quotient
more
prism
triangle
angle
digit
cylinder
money
time
times
slide
graph
nine
add
addition
kilogram
gram
array

product
third
set
length
cube
penny
rate
division
five
ninth
face
even

six

perimeter
minute
ten
six
sixty
zero
set
hexagon

plus
hour
carry
greater than
ten

+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

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×	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
7	0	7	14	21	28	35	42	49	56	63
8	0	8	16	24	32	40	48	56	64	72
9	0	9	18	27	36	45	54	63	72	81

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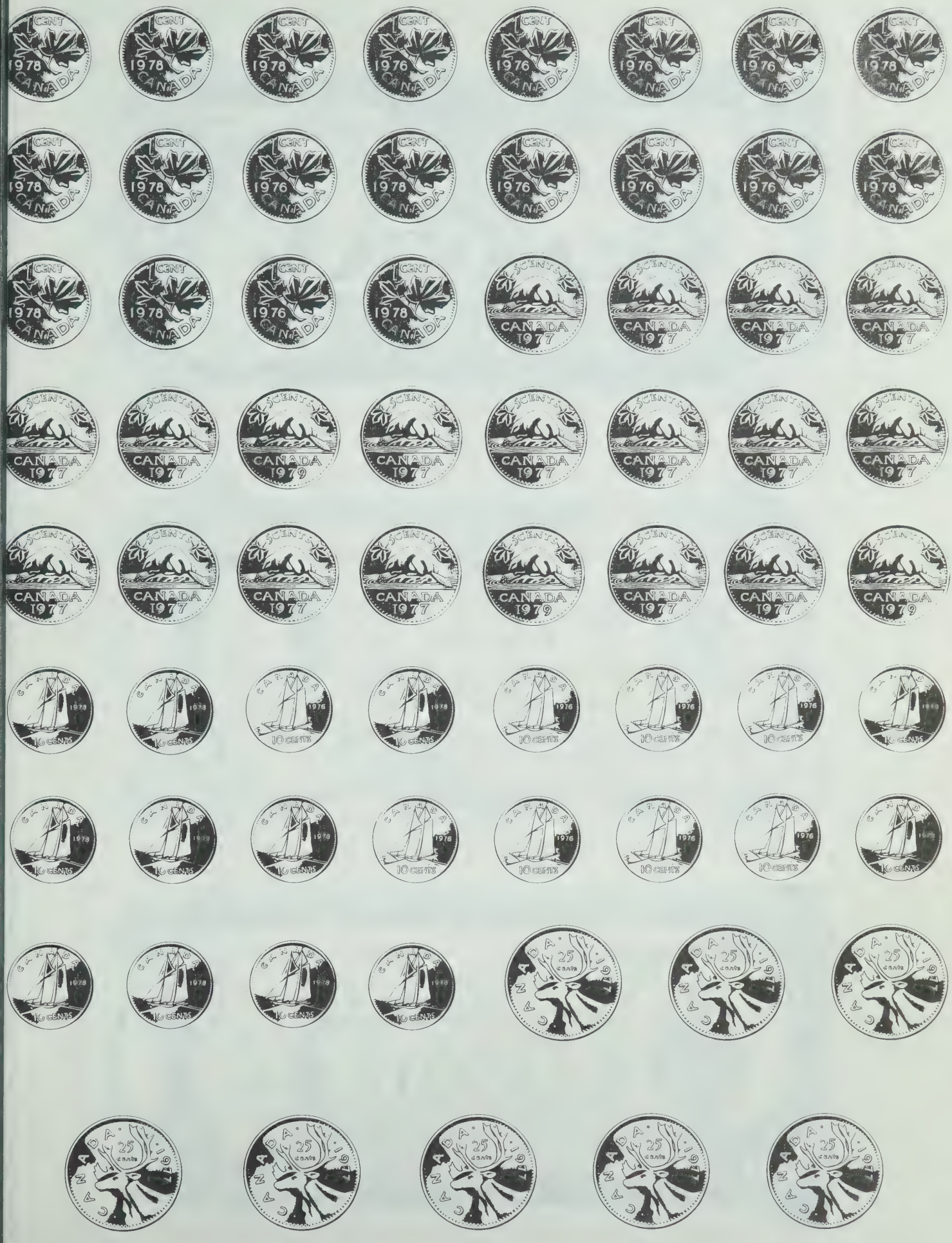

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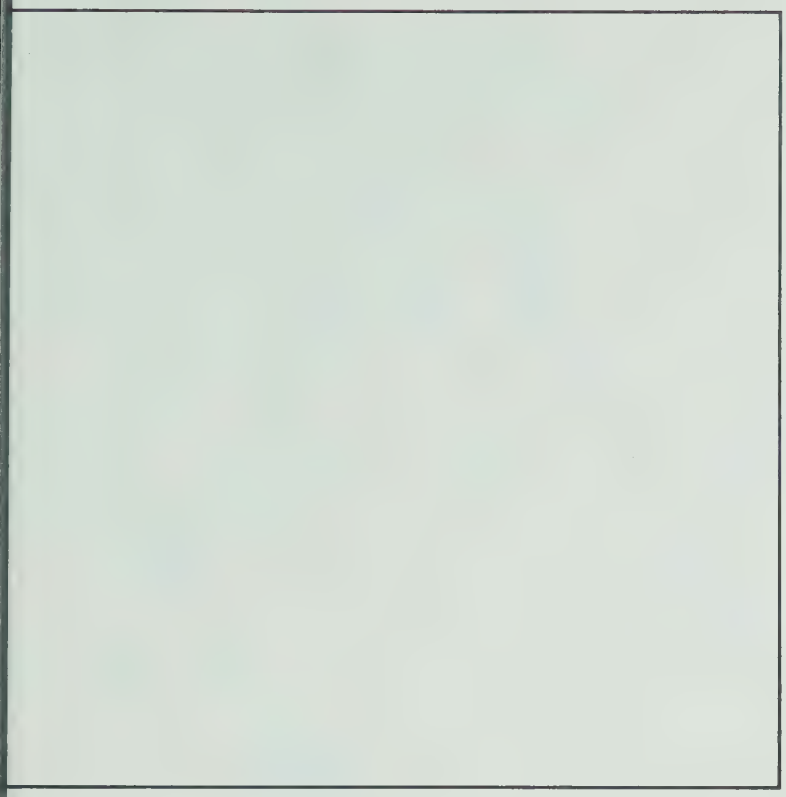

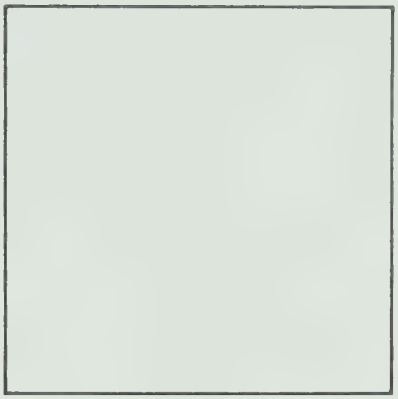

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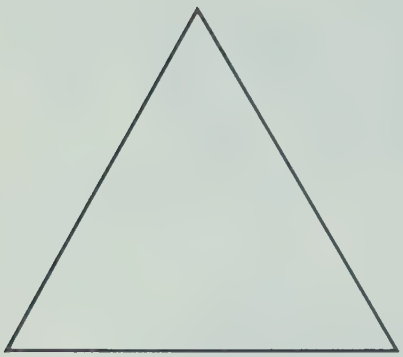

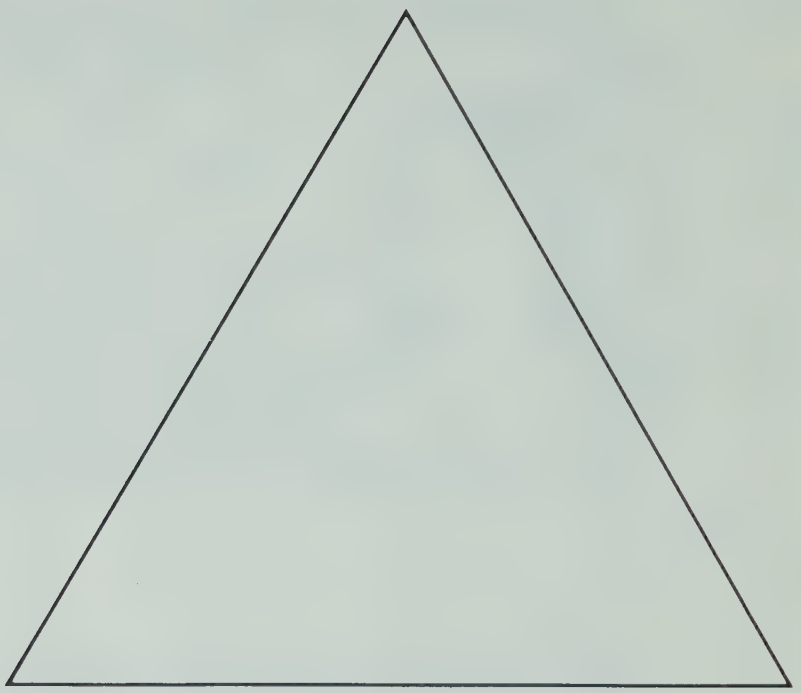

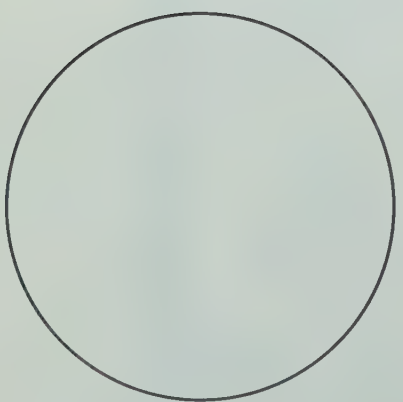

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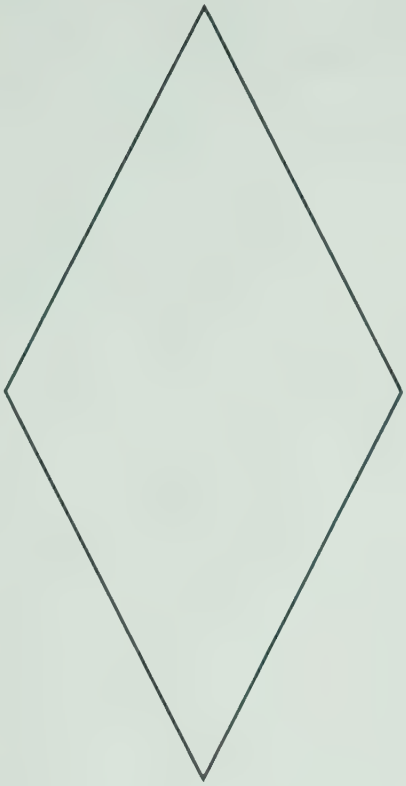

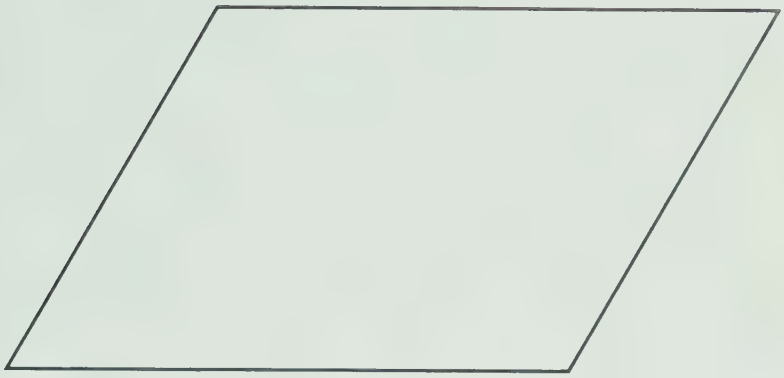

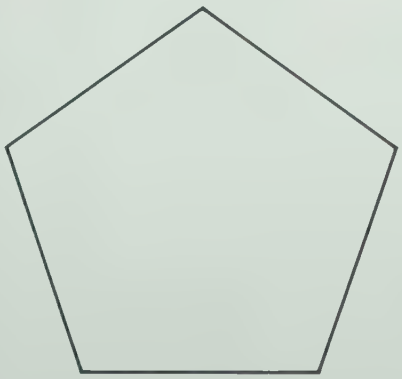

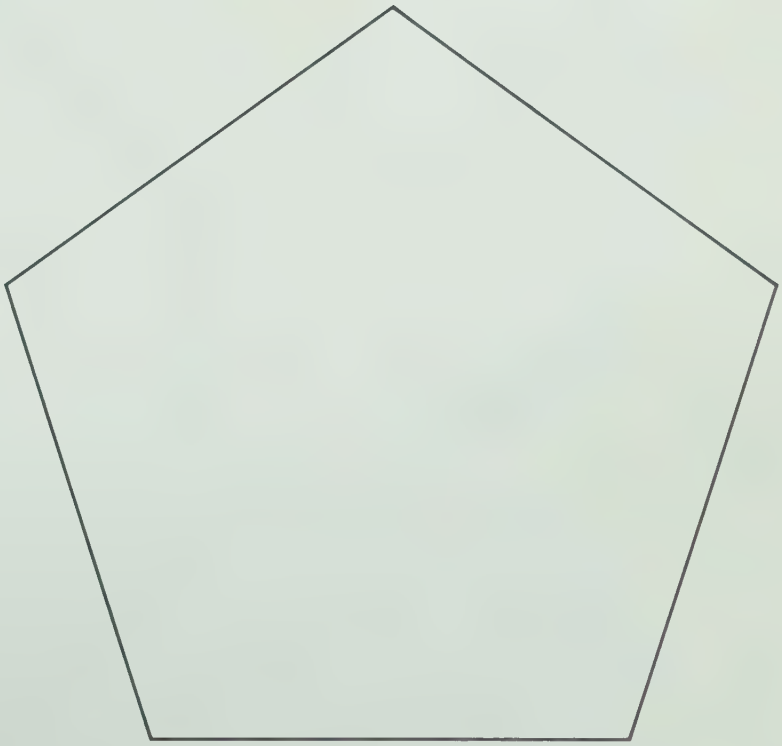

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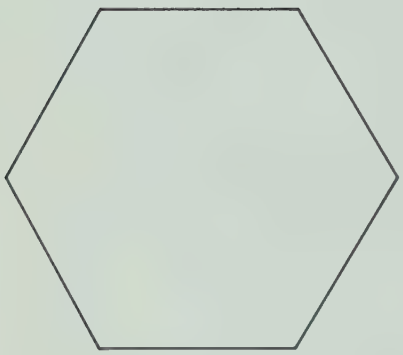

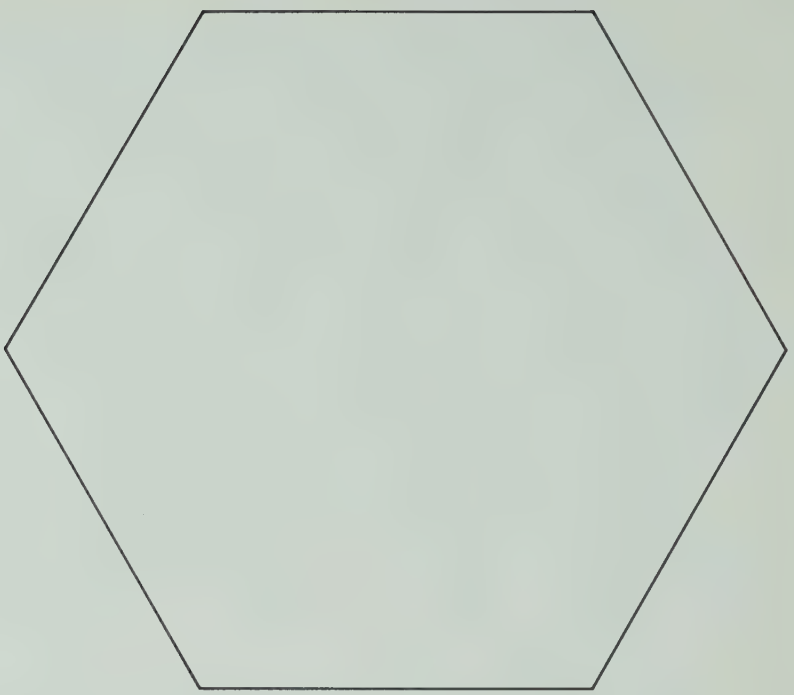

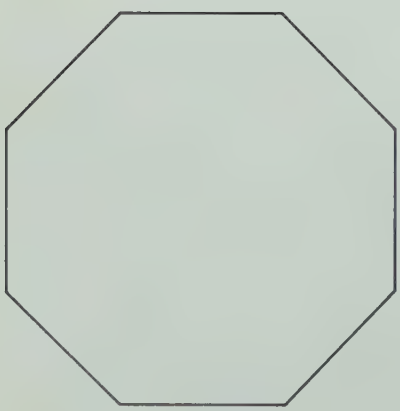

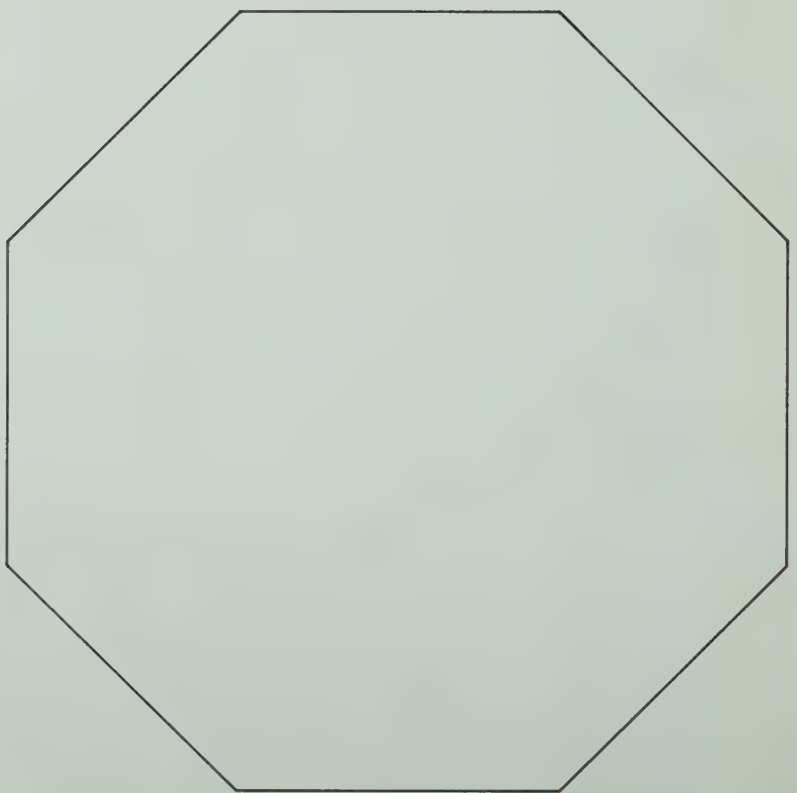

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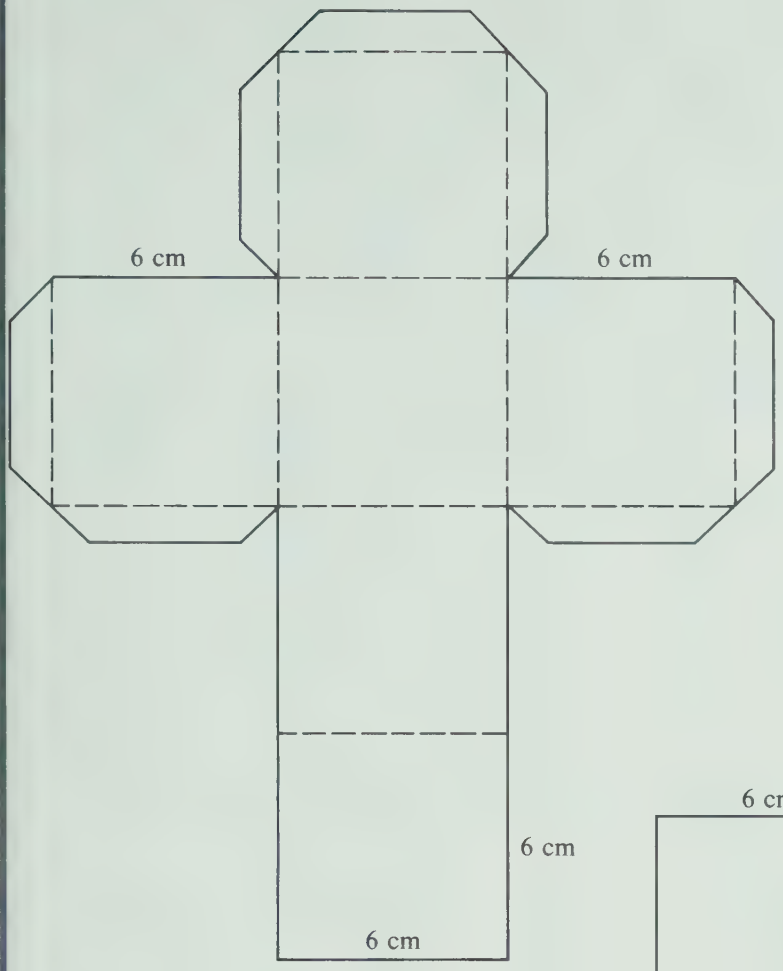
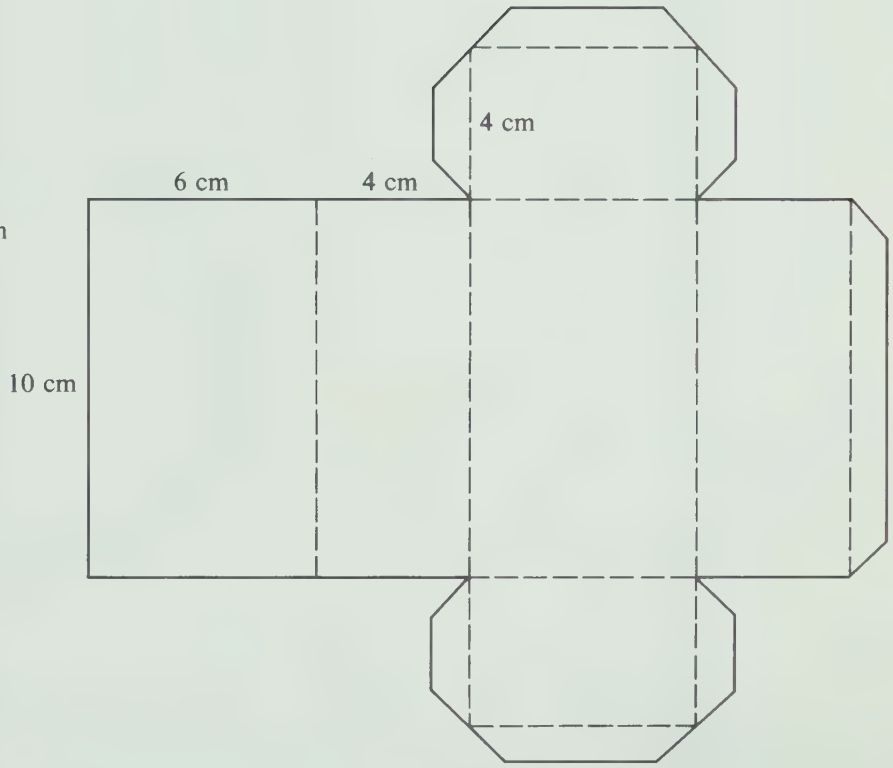
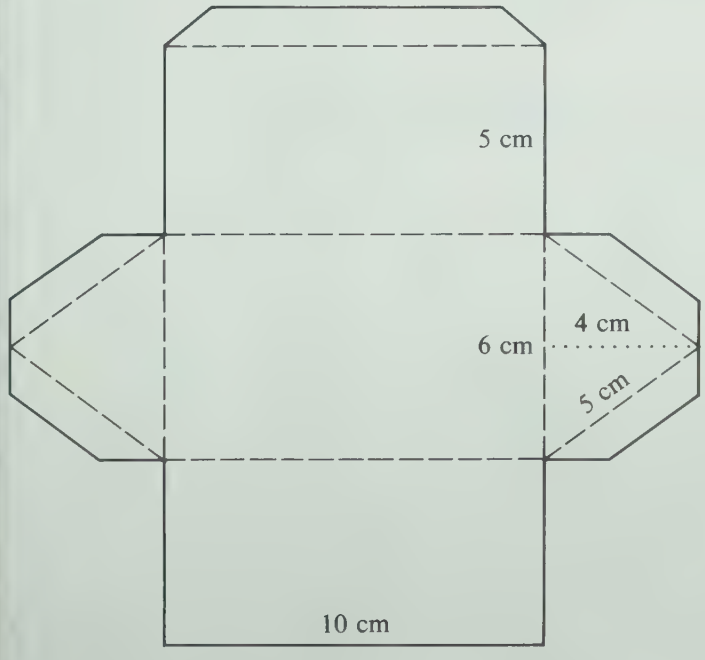


Cube



Rectangular Prism

Triangular Prism



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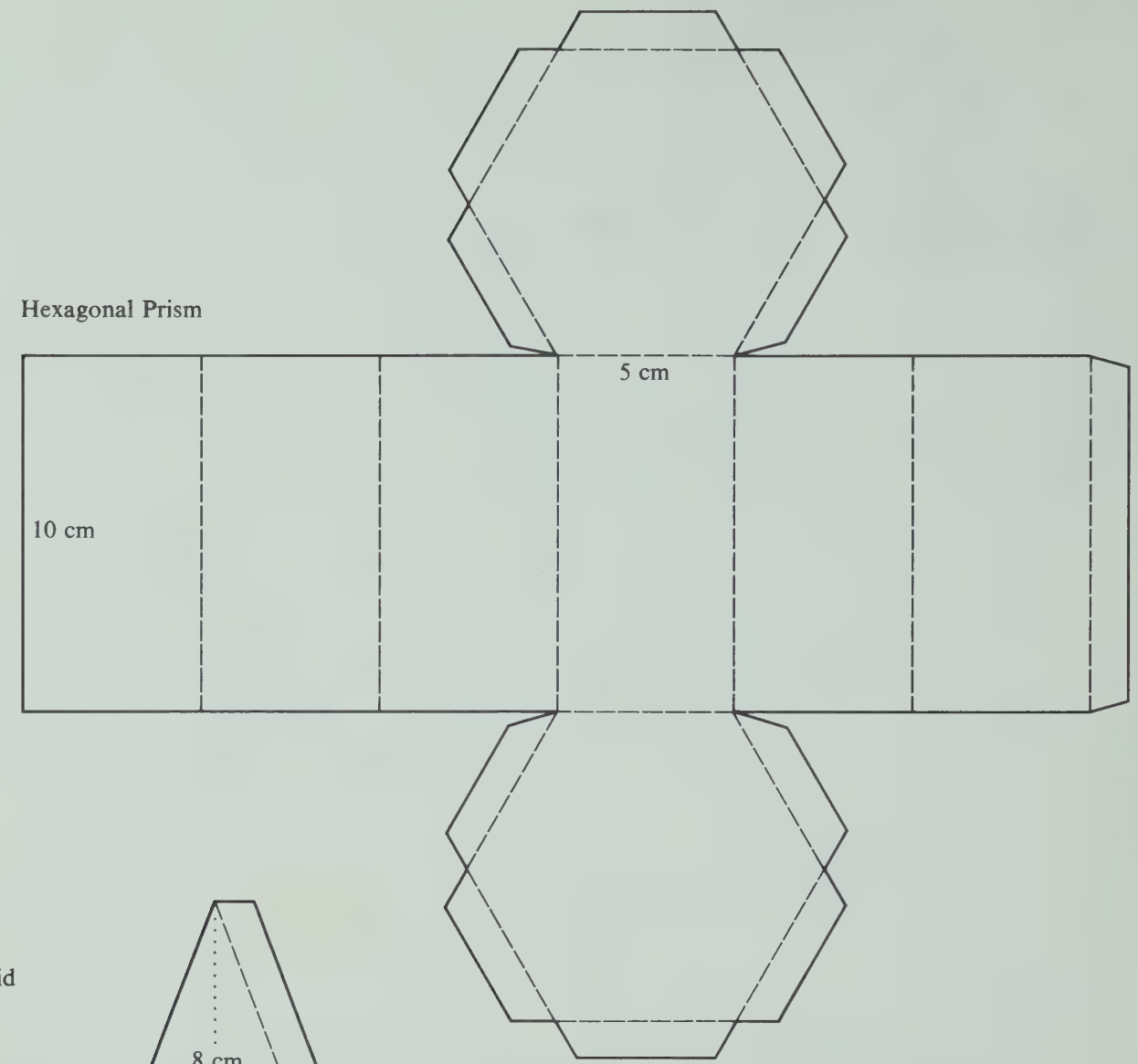
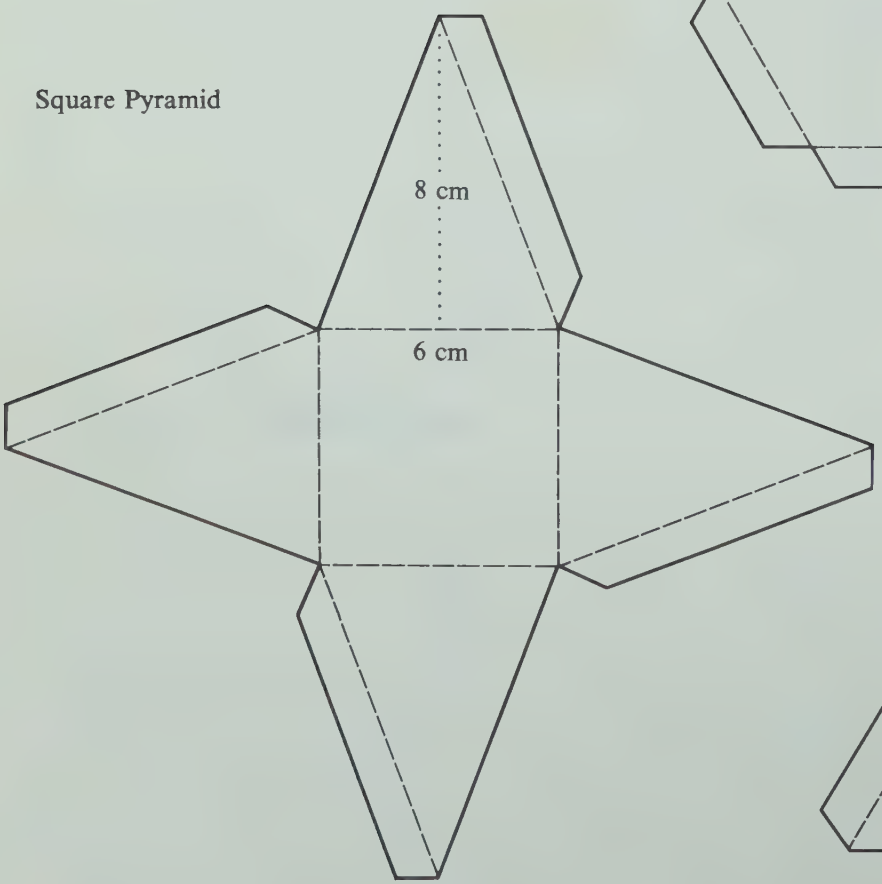
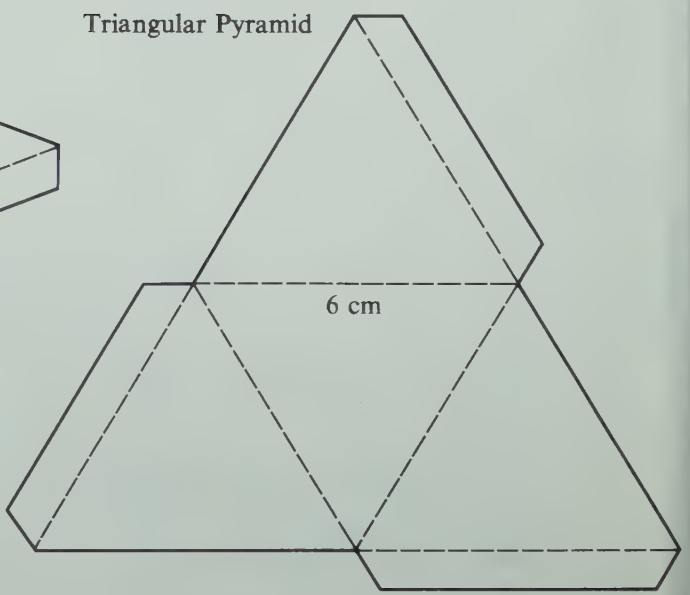
Hexagonal Prism



Square Pyramid



Triangular Pyramid



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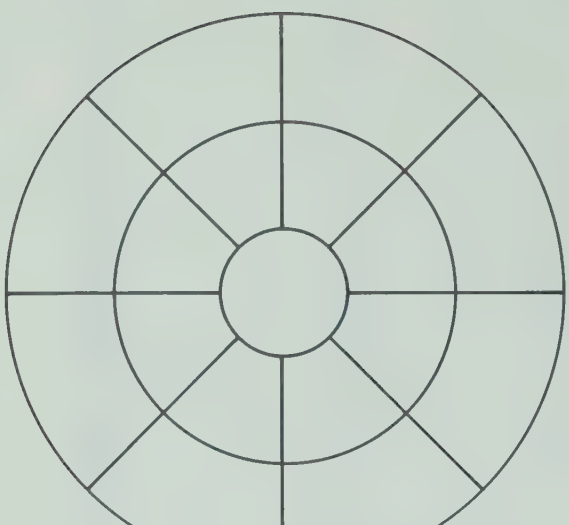

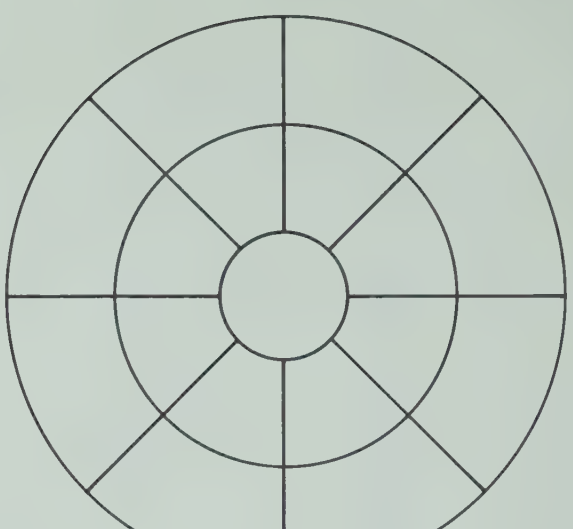

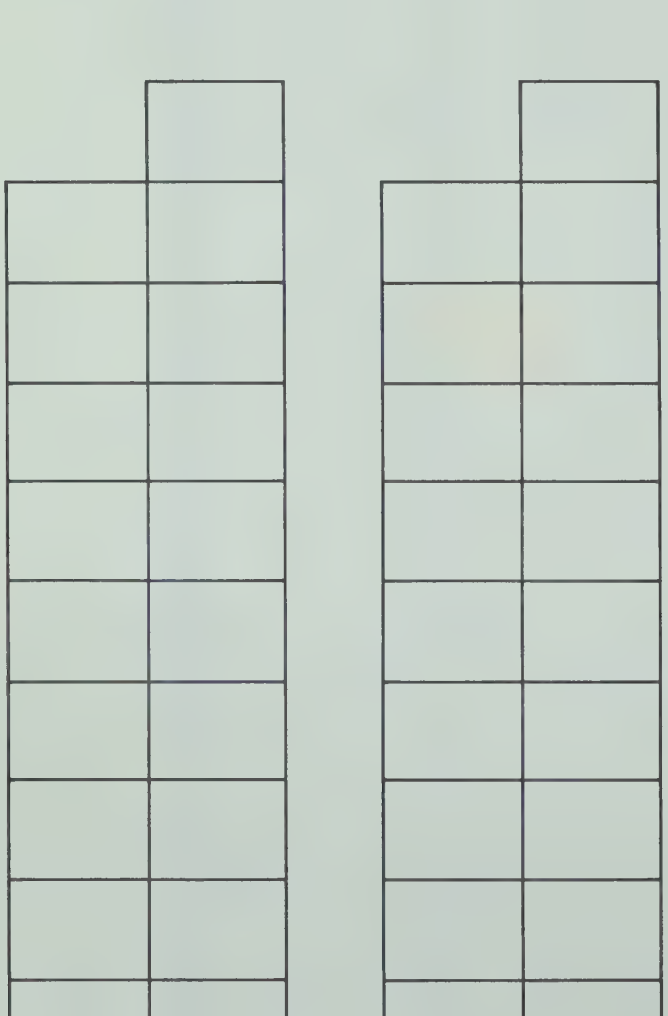

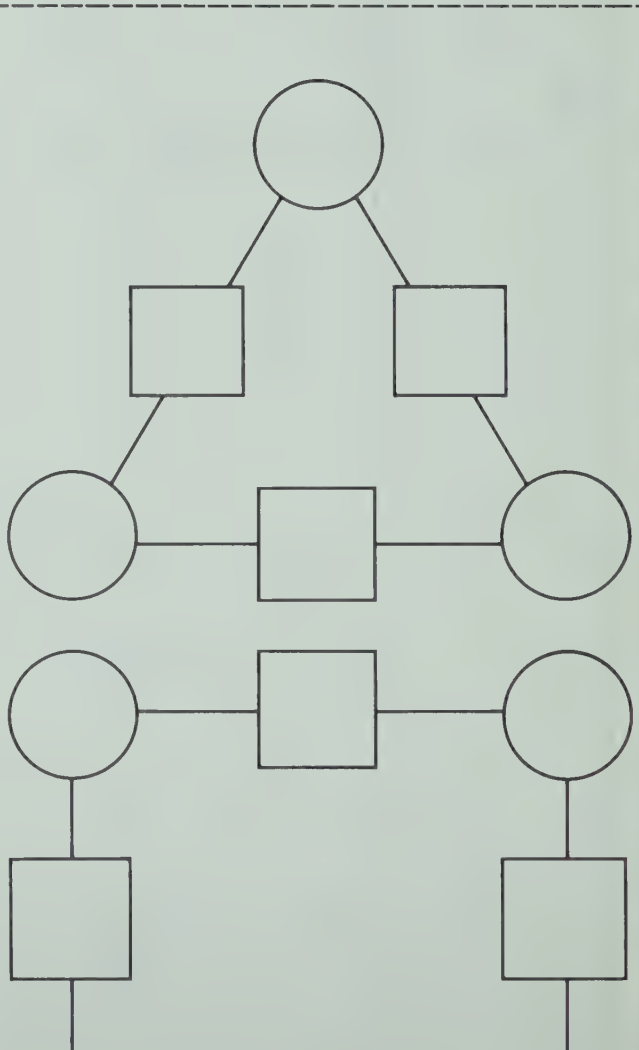

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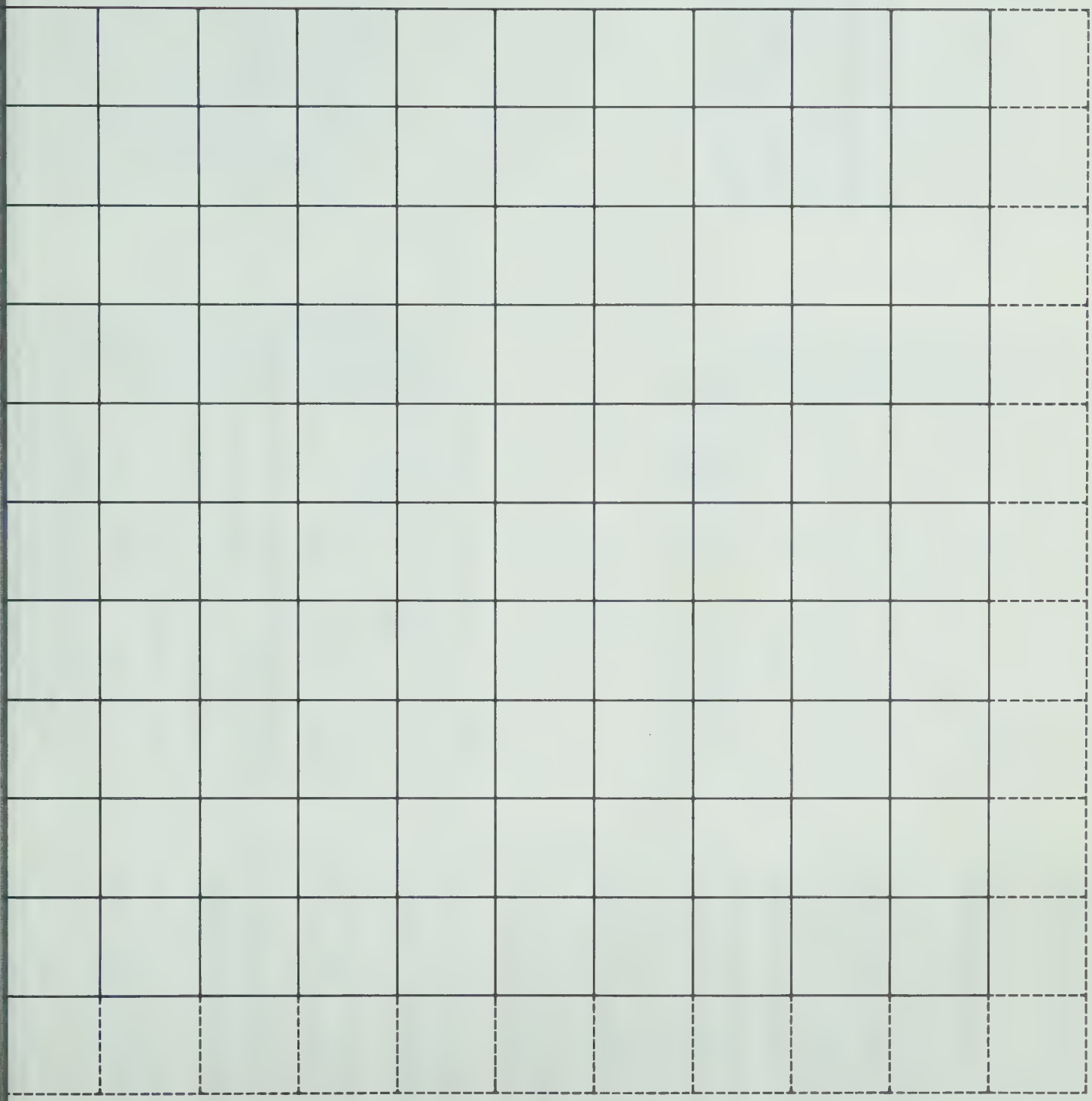

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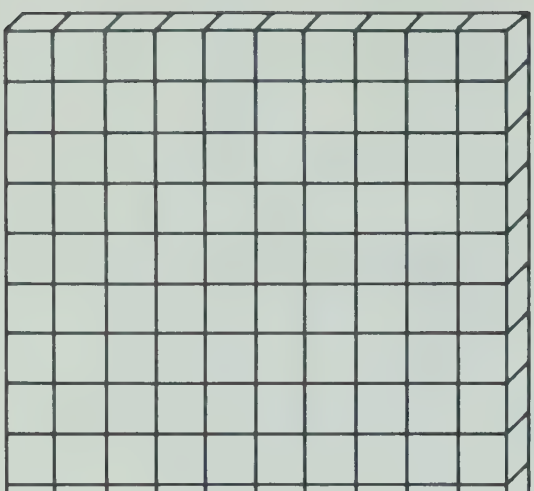

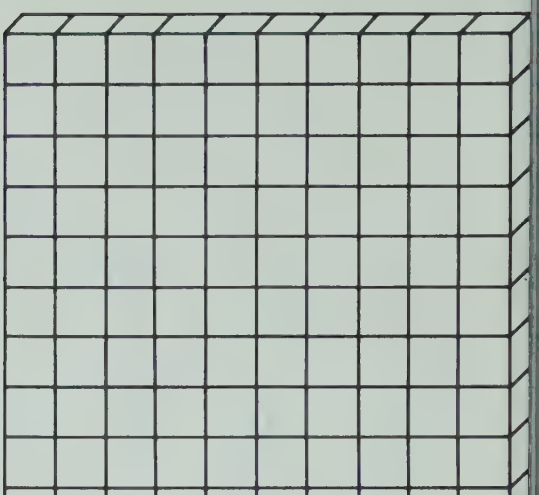

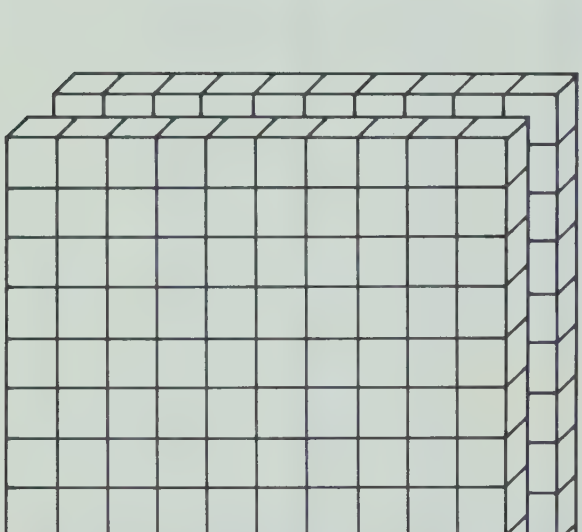

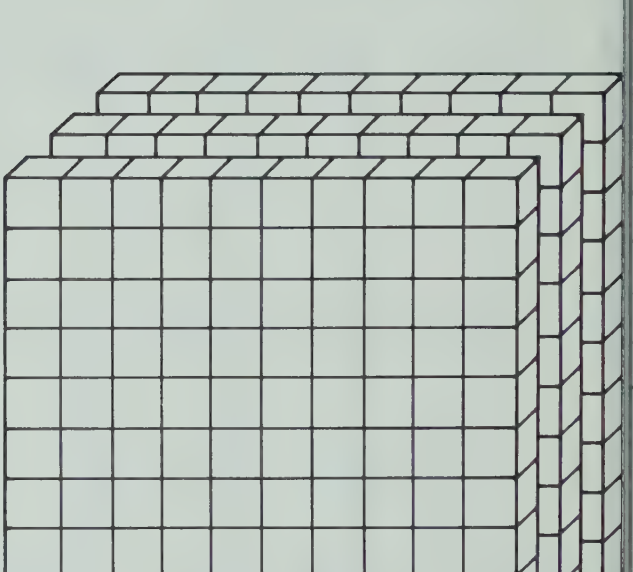

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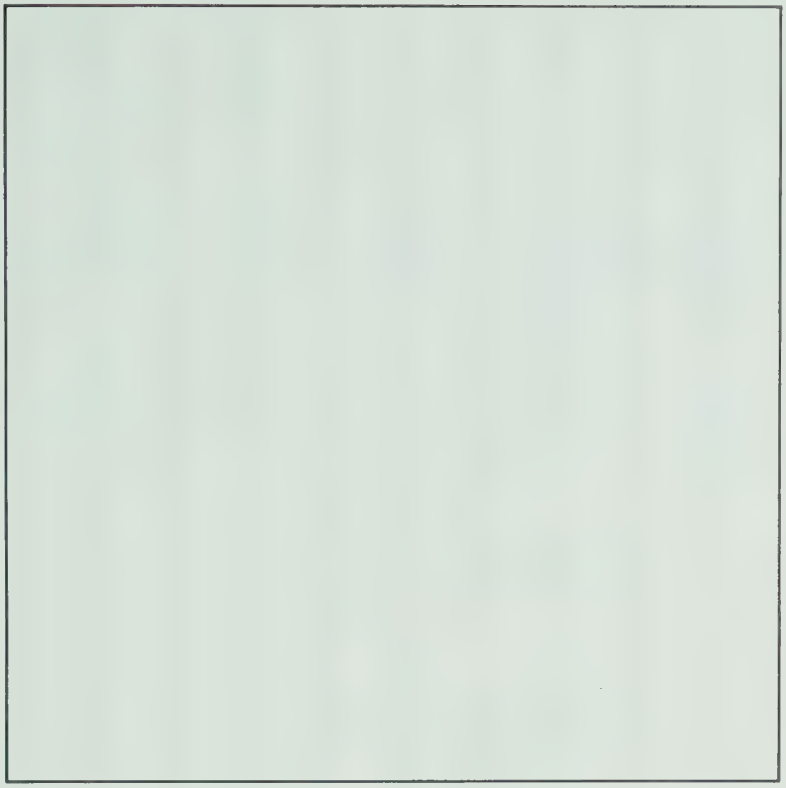

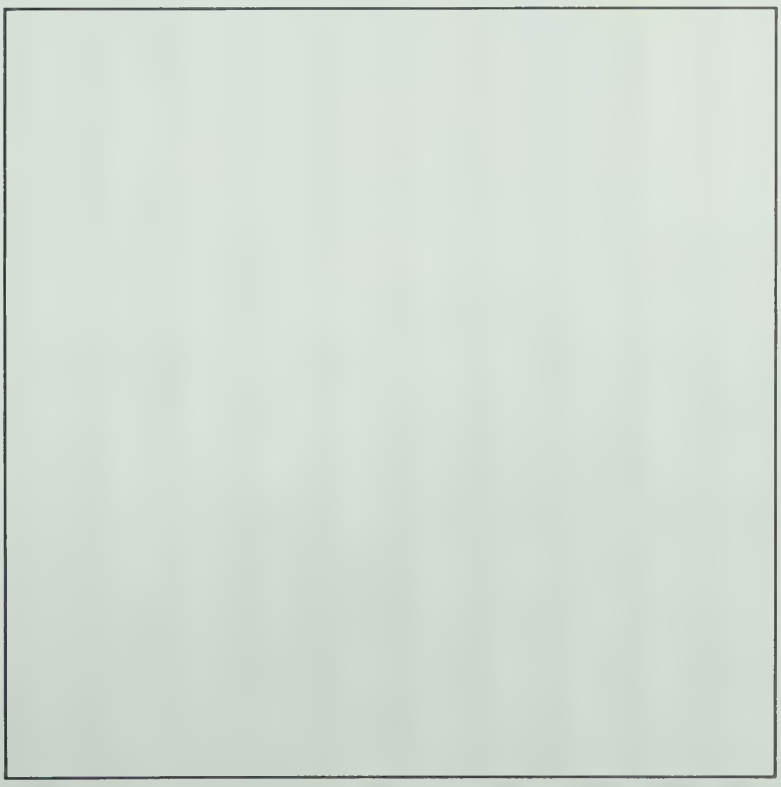

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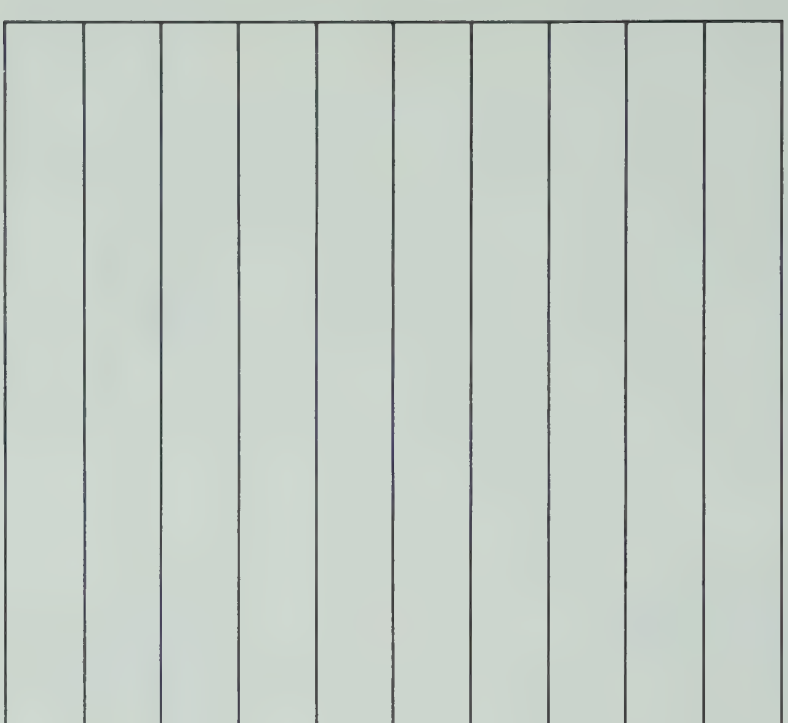

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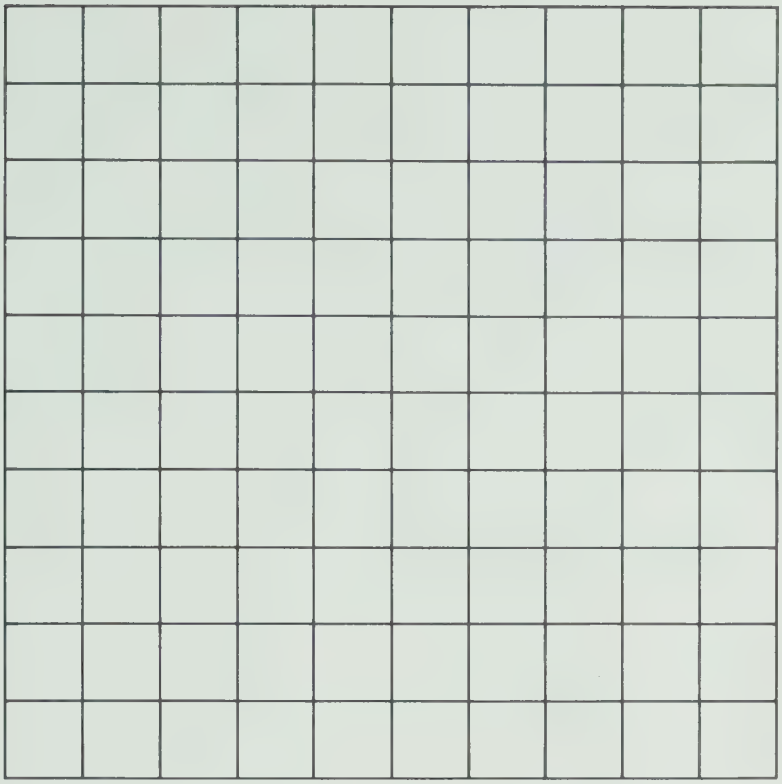

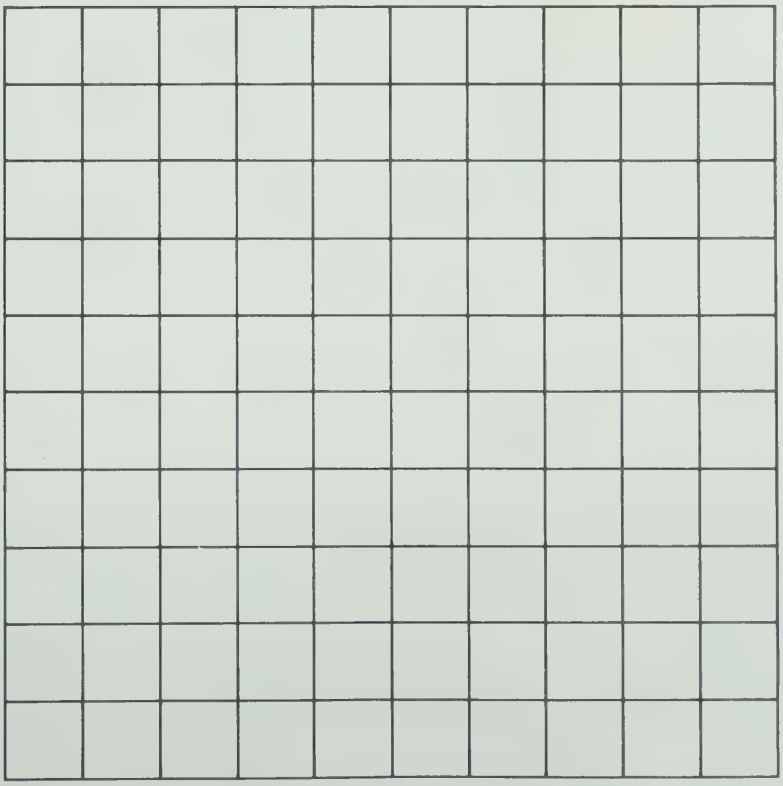

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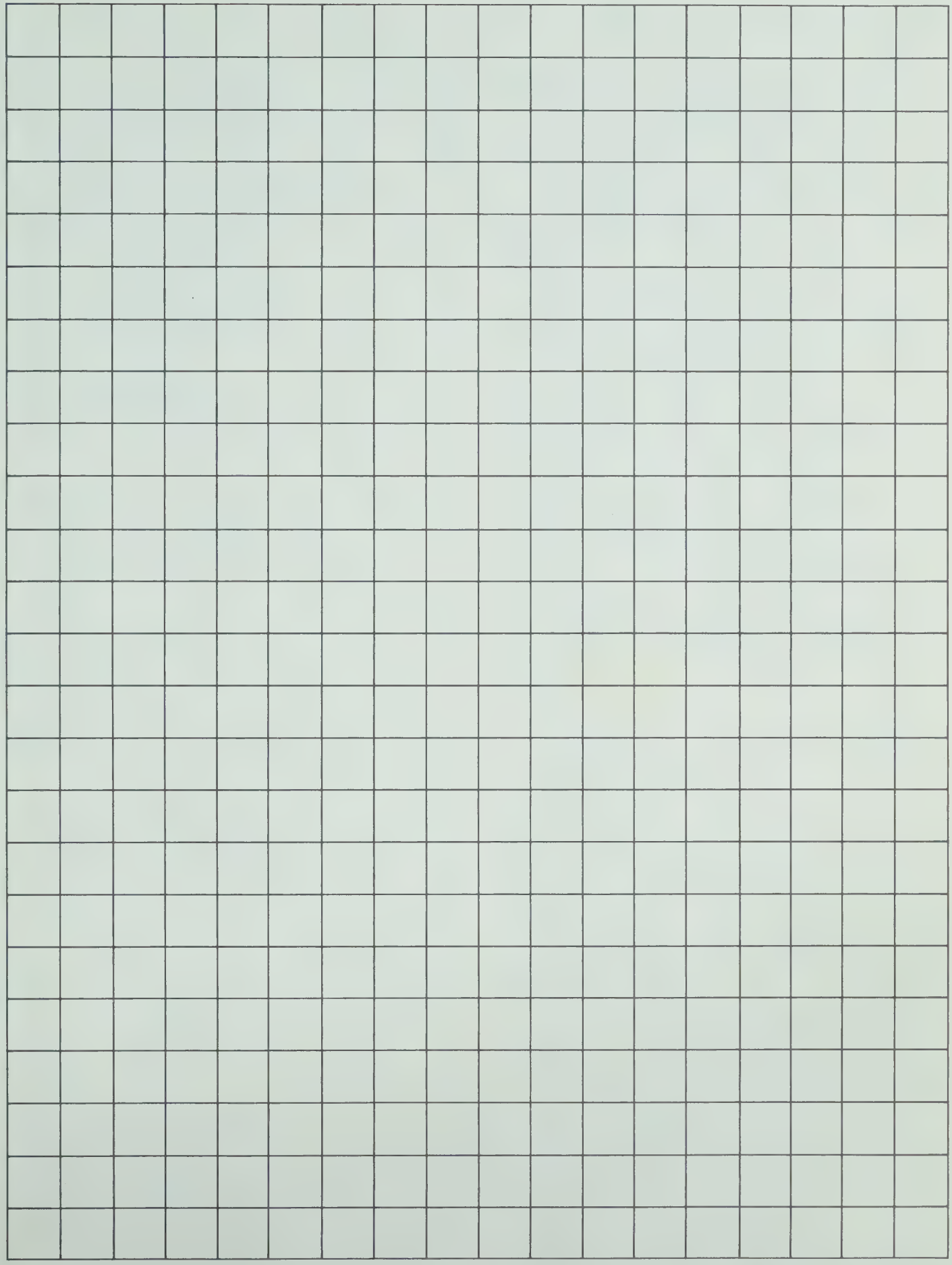

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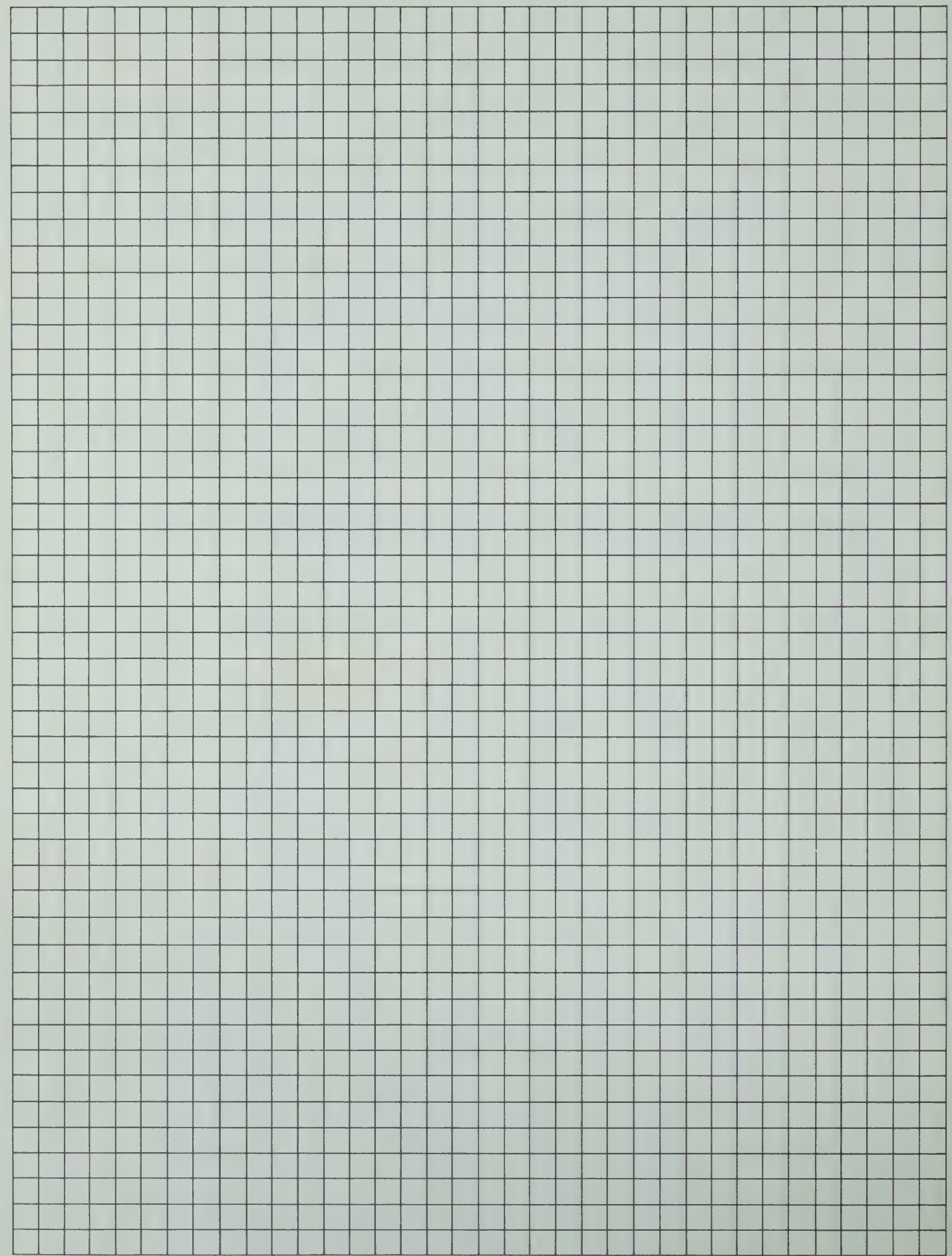

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Year-End Evaluation (See page xv.)

Name _____

Numeration

1. Reads standard numerals to 999 999 ☐
2. Writes standard numerals to 999 999 ☐
3. Interprets place value in numerals to 999 999 ☐
4. Understands sequence of numbers to 999 999 ☐
5. Orders/Compares numbers to 999 999 ☐
6. Reads/Writes words for numbers to 999 999 ☐
7. Understands/Writes expanded form for numbers to 999 999 ☐
8. Uses ordinal number concepts to *nine hundred ninety-ninth* ☐
9. Renames ones as tens and vice versa ☐
10. Renames tens as hundreds and vice versa ☐
11. Renames hundreds as thousands and vice versa ☐
12. Rounds numbers to the nearest ten, hundred, or thousand ☐
13. Continues number sequences ☐
14. Knows meaning and use of the symbol:
    a. ¢ ☐ b. $ ☐ c. = ☐
    d. > ☐ e. < ☐ f. + ☐
    g. − ☐ h. × ☐ i. ÷,) ☐
15. Understands/Uses the term:
    a. greater than ☐ b. less than ☐ c. equals ☐
16. Reads/Writes Roman numerals to C ☐
17. Reads/Writes words and numerals for proper and mixed form for parts of wholes and sets
    a. halves ☐ b. thirds ☐ c. fourths ☐
    d. fifths ☐ e. tenths ☐
18. Reads/Writes decimals to 99.99 ☐
19. Orders/Compares decimals to 99.99 ☐
20. Interprets place value in two-place decimals ☐
21. Rounds one-place decimals to 19.9 to the nearest whole number ☐
22. Matches decimals with points on a number line ☐
23. Renames tenths as ones and vice versa ☐
24. Renames hundredths as tenths and vice versa ☐
25. Interprets dollars-and-cents notation ☐
26. Express amounts of money using decimals ☐
27. Identifies/Uses equivalent fractions ☐
28. Relates fractions and decimal amounts of money ☐
29. Identifies/Uses equivalent fractions and decimals ☐
30. Orders/Compares fractions using decimal equivalents ☐
31. Identifies/Uses equivalent fraction names for 1 ☐

Operations

Addition

1. Understands/Uses the term:
    a. add ☐ b. plus ☐
    c. addend ☐ d. sum ☐
2. Understands the operation ☐
3. Understands addition properties:
    a. commutative (order) ☐
    b. associative (grouping) ☐
4. Knows the basic facts for sums to 18 ☐
5. Adds two-digit numbers, no regrouping ☐
6. Adds two-digit numbers, regrouping ☐
7. Adds three-digit numbers, no regrouping ☐
8. Adds three-digit numbers, regrouping ☐
9. Adds four-digit numbers, no regrouping ☐
10. Adds four-digit numbers, regrouping ☐
11. Adds three numbers, up to four digits each ☐
12. Estimates sums by rounding when
    a. the addends are whole numbers ☐
    b. the addends are decimals to 19.9 ☐
13. Adds two-place decimals, sums to 99.99 ☐
14. Adds two proper or mixed-form fractions with equal denominators for halves, fourths, tenths ☐
15. Adds amounts of money ☐
16. Solves problems using addition ☐

Subtraction

1. Understands/Uses the term:
    a. subtract ☐ b. minus ☐ c. difference ☐
2. Understands the operation
    a. take away (remainder) ☐
    b. how many more or fewer (difference) ☐
3. Relates subtraction to addition ☐
4. Knows the basic facts for minuends to 18 ☐
5. Subtracts, uses addition to check ☐
6. Subtracts two-digit numbers, no regrouping ☐
7. Subtracts two-digit numbers, regrouping ☐
8. Subtracts three-digit numbers, no regrouping ☐
9. Subtracts three-digit numbers, regrouping ☐
10. Subtracts four-digit numbers, no regrouping ☐
11. Subtracts four-digit numbers, regrouping ☐
12. Subtracts two-place decimals, minuends to 99.99 ☐
13. Subtracts proper or mixed-form fractions with equal denominators for halves, fourths, tenths ☐
14. Subtracts amounts of money ☐
15. Simplifies number expressions with parentheses ☐
16. Solves problems using subtraction ☐

Multiplication

1. Understands/Uses the term:
    a. multiply ☐ b. times ☐
    c. factor ☐ d. product ☐
2. Understands the operation ☐
3. Relates to repeated addition ☐
4. Knows the basic facts, products to 81 ☐
5. Finds missing factor in a multiplication fact ☐
6. Uses multiplication to find the size of an array ☐
7. Understands commutative property ☐
8. Multiplies 10 and multiples of 10 by one-digit numbers ☐
9. Multiplies 100 and multiples of 100 by one-digit numbers ☐
10. Multiplies a two-digit number
    a. by a one-digit number ☐
    b. by a multiple of ten from 10 to 90 ☐
    c. by a two-digit number ☐
11. Multiplies a three-digit number
    a. by a one-digit number ☐
    b. by a multiple of ten from 10 to 90 ☐
    c. by a two-digit number ☐
12. Multiplies three or four one-digit numbers ☐
13. Multiplies a one-place decimal to 9.9 by a whole number less than 10 ☐
14. Estimates a product by rounding when
    a. the factors are whole numbers ☐
    b. the factors are decimals to 19.9 ☐
15. Multiplies amounts of money, to $9.99 ☐
16. Simplifies number expressions with parentheses ☐
17. Solves problems using multiplication ☐

Division

1. Understands/Uses the term:
   a. divide ☐ b. quotient ☐
   c. divisor ☐ d. remainder ☐
2. Understands the operation to find
   a. the number in each group (sharing) ☐
   b. the number of equal groups (measurement) ☐
3. Uses an array to help find a quotient ☐
4. Relates division to multiplication ☐
5. Writes families of related facts ☐
6. Uses multiplication to divide ☐
7. Knows the basic division facts, quotients to 81 ☐
8. Divides multiples of 10 by one-digit numbers ☐
9. Divides a two-digit number by a one-digit number
   a. no regrouping, remainder zero ☐
   b. regrouping tens as ones, remainder zero ☐
10. Divides a three-digit number by a one-digit number
    a. no regrouping, remainder zero ☐
    b. regrouping tens as ones, remainder zero ☐
    c. regrouping hundreds as tens, remainder zero ☐
    d. two regroupings, remainders ☐
11. Divides to find an average ☐
12. Solves problems using division ☐

Measurement

Area

1. Understands the concept ☐
2. Finds area in square centimetres by counting whole units and half units ☐
3. Uses multiplication to find the area of a rectangular shape in square centimetres, square decimetres, square metres ☐
4. Recognizes/Uses the term and its symbol:
   a. square centimetre (cm^2) ☐
   b. square decimetre (dm^2) ☐
   c. square metre (m^2) ☐

Capacity

1. Recognizes/Uses the term and its symbol:
   a. millilitre (mL) ☐ b. litre (L) ☐
2. Chooses the best estimate for a capacity ☐
3. Relates millilitres and litres ☐

Length

1. Recognizes/Uses the term and its symbol:
   a. millimetre (mm) ☐ b. centimetre (cm) ☐
   c. decimetre (dm) ☐ d. metre (m) ☐
   e. kilometre (km) ☐
2. Estimates/Measures in
   a. millimetres ☐ b. centimetres ☐
   c. decimetres ☐ d. metres ☐
3. Relates centimetres, decimetres, and metres, using decimals ☐
4. Relates metres and kilometres, using decimals ☐
5. Expresses lengths given in one unit of measure in terms of another unit of measure ☐
6. Chooses the best estimate for a length ☐
7. Chooses the preferred unit for measuring a given length ☐
8. Uses addition to find the perimeter of a shape ☐

Mass

1. Recognizes/Uses the term and its symbol:
   a. gram (g) ☐ b. kilogram (kg) ☐
2. Chooses the best estimate for a mass ☐
3. Relates grams and kilograms ☐

Money

1. Gives money values in dollars and cents ☐
2. Rounds amounts to nearest ten, hundred, or thousand ☐
3. Adds/Subtracts four-place amounts ☐
4. Divides amounts in dollars only ☐
5. Multiplies three-place amounts ☐
6. Solves problems involving money ☐

Time

1. Chooses the preferred unit of time from seconds, minutes, hours, days, weeks, months, years ☐
2. Relates units of time ☐
3. Writes times to the minute using a.m. and p.m. ☐
4. Expresses times on a 12-hour clock as times on a 24-hour clock and vice versa ☐
5. Adds/Subtracts times ☐

Volume

1. Finds volume by counting centimetre cubes ☐
2. Finds volume by counting decimetre cubes ☐
3. Finds volume by counting metre cubes ☐
4. Recognizes/Uses the term and its symbol:
   a. cubic centimetre (cm^3) ☐ b. cubic decimetre (dm^3) ☐
   c. cubic metre (m^3) ☐

Graphing

1. Organizes information ☐
2. Draws and interprets pictographs ☐
3. Draws and interprets bar graphs ☐
4. Reads scales ☐

Problem Solving

1. Determines extra information required ☐
2. Selects relevant information ☐
3. Organizes information ☐
4. Writes equations to match word problems ☐
5. Reads a scale for information ☐
6. Solves problems by trial and error ☐
7. Draws pictures and uses models ☐
8. Estimates answers ☐
9. Recognizes answers as reasonable ☐
10. Thinks logically ☐
11. Solves problems having more than one solution ☐
12. Solves problems involving
    a. one/two steps ☐ b. more than two steps ☐

Geometry

1. Identifies/Names/Draws lines and segments ☐
2. Identifies/Names/Draws angles ☐
3. Relates an angle to a right angle ☐
4. Draws/Names triangles and their sides and angles ☐
5. Identifies/Draws each of these polygons:
   a. hexagon ☐ b. octagon ☐ c. pentagon ☐
   d. quadrilateral ☐ e. rectangle ☐ f. square ☐
6. Identifies/Draws circles ☐
7. Identifies and names parts of a circle:
   a. center ☐ b. radius ☐ c. diameter ☐
8. Identifies/Draws shapes having line symmetry ☐
9. Identifies/Shows lines of symmetry ☐
10. Determines whether two shapes are congruent ☐
11. Identifies images of shapes for
    a. flips ☐ b. slides ☐ c. turns ☐
12. Identifies/Counts vertices, edges, faces of solids ☐
13. Recognizes patterns for making solid shapes ☐
14. Associates ordered pairs with
    a. regions on a map ☐ b. points on a grid ☐

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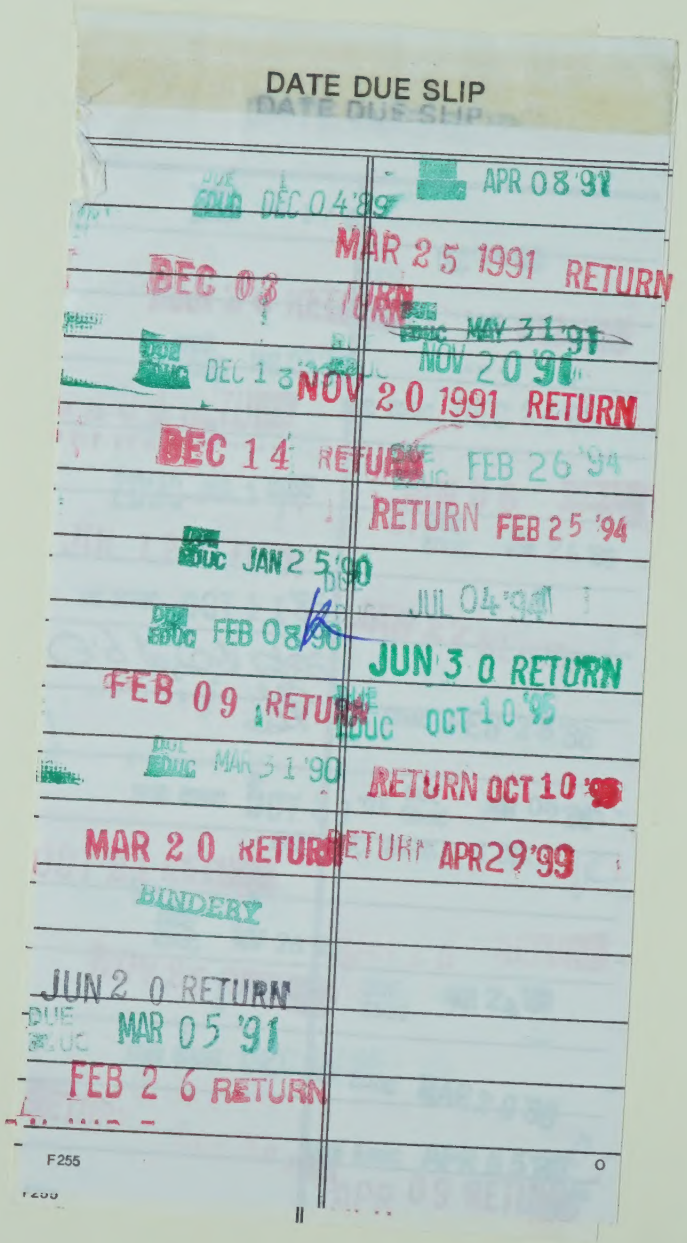

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